NUCLEAR SCIENCE ABSTRACTS

Volume 9 February 28, 1955 No. 4

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NUCLEAR SCIENCE ABSTRACTS

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GENERAL

ATOMIC POWER

1152

ATOMIC ENERGY. A SURVEY. J. Rotblat, ed. London, Taylor and Francis, Ltd., 1954. 72p.

A series of public lectures on various phases of atomic energy, delivered by prominent figures in British atomic and nuclear research during a symposium at the University of London in January and February 1954, are collected for the purpose of providing an up-to-date survey of current developments. The lectures include a review of research at Harwell by Sir John Cockcroft, a discussion of fission and fusion principles by O. R. Frisch, an evaluation of the feasibility and prospects of industrial atomic power by F. E. Simon, and a survey of radiation hazards and beneficial applications of atomic energy in technology, industry, and medicine by J. F. Loutit and E. E. Pochin. Two points of view on the moral issues of atomic energy are presented by Kathleen Lonsdale and Sir George Thomson. It is assumed that the reader does not possess specialized knowledge of the material, and the meaning of certain technical terms which do appear in the text is explained in a glossary. (K.S.)

BIOLOGY AND MEDICINE

1153

THE EFFECT OF THE HOST ON THE PROPERTIES AND SENSITIVITY OF A BACTERIAL VIRUS. Murray Friedman (Yale Univ., New Haven, Conn.). *J. Bacteriol. 68*, 274-8 (1954) Sept.

Three strains of *Bacillus megaterium* served as hosts for one particular virus, M-5. Differences in the host response were found in plating efficiency, adsorption, and antibody neutralization of the virus. The hosts reacted similarly with respect to the virus's latent period, thermal, x-ray, and deuteron inactivation. It is postulated that the host does not significantly affect the internal virus entity, since the same or similar virus units appear to be responsible for multiplication in different hosts. (auth)

RADIATION EFFECTS

1154

Brookhaven National Lab.

CHROMOSOME REJOINING CAPACITY WITH RESPECT TO BREAKAGE SENSITIVITY TO X-RAYS AND THERMAL NEUTRONS. Eleanor Deschner and A. H. Sparrow. [1954]. 35p. (BNL-2045)

The relative biological effects of x radiation and thermal neutrons were compared in an attempt to establish the relative effectiveness of the two radiations on the induction of breakage and on the degree of rejoining during various stages of microsporogenesis in Trillium. An attempt was also made to determine whether or not the apparent inverse relationship previously found to exist between breakage and rejoining would hold true at other stages in the nuclear cycle of Trillium. (C.H.)

1155

Brookhaven National Lab.

DECREASE IN UPTAKE OF IRON BY DUCK ERYTHROCYTES IN VITRO FOLLOWING WHOLE-BODY X-IRRADIATION. J. Raymond Klein. [1954]. 6p. (BNL-2071)

Whole-body x irradiation of ducks is followed by a decrease in uptake of iron by blood cells in vitro. The uptake by leucocytes and the decrease in leucocyte level of blood following irradiation does not account for the decrease. Therefore, it appears that the irradiation is followed by decrease in the ability of erythrocytes to take up iron in vitro. (auth)

1156

Tennessee Univ.

AGRICULTURAL RESEARCH PROGRAM. SEMI-ANNUAL PROGRESS REPORT FOR JANUARY 1, 1954 TO JUNE 30, 1954. Dec. 1954. 91p. Contract AT-40-1-GEN-242. (ORO-133)

Data are presented from studies of the effect of dietary Ca on the secretion of ingested Sr^{89}—Sr^{90} in milk; the effects of age on the absorption of Ca^{45} and Sr^{89} by cattle; effect of dietary milk on the absorption of Ca^{45} and Sr^{89}; the tissue distribution of Sr^{89} and Ca^{45} in cattle tissues; a comparison of the toxicity of Ra and Sr^{90} for lambs; investigations of the use of excised tailbone of cattle as a measure of skeletal deposition of radioisotopes; the utilization of continually ingested Sr^{90} in embryonic development and bone formation in rats; the tissue distribution of intravenously administered I^{131} in dairy cows; the radio toxicology of Ni^{63} for rats; the toxicology of Cr^{51} and Zn^{65} for cattle; the radiometric determination of trace amounts of Ni^{63} in animal tissues; tracer studies of Ca metabolism in cattle and rats; the deposition of S^{35} in fluorine-treated animals; studies of the metabolism of F^{18} in domestic animals; the effect of dietary Ca and P levels upon the physiological behavior of Ca and P in the rat; tracer studies on the effects of feeding thyroxine to dairy cows; tracer studies of the leaching and plant uptake of Ca from various soil types; the physiological effects on burros of chronic exposure to γ radiation; studies on the initial appearance, gross pathology, degree of healing and chronic histopathologic changes in the skin of burros, horses, cattle and sheep following exposure to β radiation applied in activated amorphous red phosphorous plaques; bacterial transfer in burros subjected to lethal total-body irradiation; a preliminary evaluation of the toxicity of flesh of lethally irradiated sheep, beef, and swine when fed to dogs and rats; and preliminary studies of the toxicology of phenothiazine for horses. (For preceding period see ORO-110.) (C.H.)

1157

Atomic Energy Project, Univ. of Rochester

STUDIES ON FLASH BURNS: THE INFLUENCE OF EXPOSURE TIME AND IRRADIANCE ON THE THERMAL

PROTECTIVE QUALITIES OF TWO FABRIC ASSEMBLIES. George Mixter, Jr. and Herman E. Pearse. Nov. 16, 1954. 29p. Contract W-7401-eng-49. (UR-355)

The protective qualities of two types of fabric barrier against radiant energy burns in pigs have been studied over a wide range of exposure time and irradiance. The most notable characteristic of these barriers is the complexity of their protective patterns at the higher irradiances. A 3-dimensional graphic method is used to express this bizarre behavior. The studies reveal the marked increase of protection by separation of fabric from skin, and the significance of post-exposure flame in the production of burns. In the case of heavier fabric ensembles, it is demonstrated that the cloth itself can act as a thermal reservoir, but that at high irradiances the rapid destruction of this reservoir operates to increase the protection to the underlying skin. (auth)

1158

REACTION OF SKIN AFTER LONG WAVE X-RAYS AND AFTER CATHODE RAYS. Ernest Wilhelmy. Translated from Strahlentherapie 55, 498-523(1936). 28p. (AEC-tr-1979)

1159

X RADIATION, TEST OF GROWTH AND MUTATIONS. A. Moës. J. belge radiol. 37, No. 4, 572-87(1954). (In French)

The physiological action of x rays can be evidenced by a growth test on Hordeum sativum Jess. using a conventional method. The data obtained by this test are compared to the rate of survival, to the fertility of surviving plants and to the mutation rates. The growth test can be applied to the study of different questions, for example, relation between radiosensitivity and development of the corn, relation between radiosensitivity and wavelength of the radiation, and sensitivity to x rays of different tissues and different species. (auth)

1160

CHANGES IN THE LATENT PERIOD OF A BACTERIAL VIRUS. Ernest Pollard, W. R. Adams, and Shirley Robbins (Yale Univ., New Haven, Conn.). Radiation Research 1, 514-22(1954) Dec.

The latent period of T1 bacteriophage which has been dried and either heated or irradiated by ionizing radiation has been observed to increase. For deuteron and α-particle bombardment the latent period is doubled for 11×10^{11} and 5×10^{11} particles per square centimeter respectively. For x irradiation doubling occurs at 1.45×10^{6} r. The cross section for destruction of plaque-forming ability for T1 increases for slow α-particle bombardment to a roughly constant value of 1.6×10^{-11} cm^2. Latent period increase for wet x irradiation in the absence of protective agents occurs only after considerable bombardment and then takes place sharply. Fluctuations in latent period increases are quite marked. It is tentatively suggested that about 100 long, thin units, some of which are vital to survival and others are rate increasers, are present inside the virus, and that these are the units inactivated by ionizing radiation. (auth)

1161

EFFECT OF WHOLE-BODY X-IRRADIATION ON LIPIDS IN THE LIVER, KIDNEY, AND SPLEEN OF FASTED RATS. W. E. Cornatzer, J. P. Davidson, O. D. Engelstad, and Carol Simonson (Univ. of North Dakota Medical School, Grand Forks). Radiation Research 1, 546-50(1954) Dec.

The effect of whole-body x irradiation in the phospholipid synthesis and lipid distribution was studied in the liver, spleen, and kidney of the fasted rat. Phospholipid synthesis was somewhat reduced in the spleen. No significant changes were observed in lipid P in the kidney, or in the concentration of cholesterol in the spleen, liver, and kidney due to irradiation. (auth)

1162

THE TREATMENT OF CARCINOMA OF THE OVARIES, PLEURA AND PERITONEUM WITH RADIOACTIVE GOLD. F. Remold, A. Siegert, and H. Stamm. Strahlentherapie 94, No. 3, 367-73(1954). (In German)

After a short survey on methodic and technical details, the results obtained in the treatment with radioactive gold of 11 patients suffering from ovarian carcinoma, as well as of carcinoma of the pleura and the peritoneum are presented. The subjective compatibility was relatively good. Regression of the ascites was merely observed in one of the cases. The growth of the tumors remained uninfluenced; the general condition of health was always impaired. Application of radioactive gold seems to be justified as a means of supplementing and extending the conventional methods of treatment. It promises sufficiently strong action on micrometastases of the peritoneum, resp. of the pleura. (tr-auth)

1163

ENDOBRONCHIAL USE OF RADIOCOBALT. Konrad Peter Fischer. Strahlentherapie 94, No. 3, 374-83(1954). (In German)

At the present stage of diagnosis, operative interventions for the purpose of treating centrally located bronchial carcinomas, are usually performed too late, to be of help. An increasing number of such patients is therefore again turned over to the radiotherapist, although the results of the radiotherapeutic treatment are merely of a palliative nature. The experiences gained up to date have, however, shown that an intensive radiotherapy is apt to prolong the life of the patients and that therefore a further development of radiotherapeutic measures would certainly appear advantageous. Starting from this opinion, a method has been developed which permits the treatment of the parietal processes in the hyparterial bronchus by an additional local contact irradiation with Co^{60}. The technical problems involved in the above procedure, the possibilities of its application and the chances which it offers are discussed. (tr-auth)

1164

RELATIONSHIP BETWEEN BARTONELLA MURIS INFECTION AND ACUTE RADIATION EFFECTS IN THE RAT. J. K. Scott and J. N. Stannard (Univ. of Rochester School of Medicine and Dentistry, New York). J. Infectious Diseases 95, 302-8(1954) Nov.-Dec.

It has been shown that latent Bartonella muris infection in the rat can be activated by injecting the radioactive element, polonium^{210}, or by whole body exposure to 600 r of 250 kv x rays. The anemia develops less rapidly and is not as severe as when the infection is activated by splenectomy. It is concluded that the presence of an active bartonella infection in the rat does not exacerbate the lethal effects of an acute radiation dose, although the hematological response may be markedly altered. (auth)

1165

IRRADIATION AND ADRENAL STEROIDOGENESIS. STEROID TRANSFORMATIONS BY IRRADIATED ISOLATED PERFUSED CALF ADRENALS. George Rosenfeld, Frank Ungar, Ralph I. Dorfman, and Gregory Pincus (Worcester

Foundation for Experimental Biology, Shrewsbury, Mass. and Naval Medical Research Inst., Bethesda, Md.). Endocrinology 56, 24-9(1955) Jan.

Exposure of the isolated calf adrenal to moderate doses of gamma radiation (Co^{60}) during perfusion of various steroid substrates caused a significant reduction in the ability of the gland to carry out 11β-, 17α, and 21-hydroxylations as well as the oxidation of the Δ^5-3β-hydroxyl group to the Δ^4-3-ketone group. The decrease in the specific enzymatic activities parallel the previously observed decrease in corticosteroid output by ACTH-stimulated irradiated glands. The present studies corroborate the view that the adrenal cortex is a radioresponsive tissue functionally, and indicate that the effect of an ionizing radiation is exerted on all the steroidogenic enzyme systems of the biosynthetic mechanism. (auth)

1166

IRRADIATION AND ADRENAL STEROIDOGENESIS. INFLUENCE OF IRRADIATION OF ISOLATED ACTH-STIMULATED CALF ADRENALS ON THEIR CORTICAL OUTPUT. Frank Ungar, George Rosenfeld, Ralph I. Dorfman and Gregory Pincus (Worcester Foundation for Experimental Biology, Shrewsbury, Mass. and Naval Medical Research Inst., Bethesda, Md.). Endocrinology 56, 30-6(1955) Jan.

Exposure of the isolated, ACTH-stimulated calf adrenal to moderate doses of gamma radiation (Co^{60}) during perfusion resulted in a significantly decreased secretion of hydrocortisone, corticosterone, and unidentified Porter-Silber chromogens. Although the cortex of irradiated animals does not exhibit marked morphological alterations, the present studies suggest that from a functional point of view, the adrenal cortex may be considered a radioresponsive tissue. (auth)

1167

SEARCH FOR AN EFFECT OF HYDROSTATIC PRESSURE ON X-RAY INACTIVATION OF YEAST. Victor W. Burns (Univ. of California, Berkeley). Arch Biochem. Biophys. 53, 450-6(1954) Dec.

Evidence has been presented to show that the x-ray lethal inactivation of haploid S. cerevisiae is not altered by hydrostatic pressures reaching 10,000 lb/in^2 applied during and after irradiation. From these results it is inferred that this lethal mutation process probably does not initially involve macromolecular unfolding. (auth)

1168

EARLY RADIATION DEATH IN GUINEA PIGS. K. C. Brace, H. L. Andrews, and E. C. Thompson (National Cancer Inst., Bethesda, Md.). Am. J. Physiol. 179, 386-9 (1954) Nov.

Guinea pigs were exposed to whole-body x radiation at graded doses between 1,000 and 25,000 r at a constant dose rate of 50 r/min. Doses between 1,000 and 5,000 r caused death in 4 to 6 days and elicited a progressive depression with few other neurological symptoms. A granulocytosis was present during the first few hours after exposure but subsided prior to death. Doses of 7,500 r or more caused death in less than 24 hours and elicited a state of hypersensitivity with convulsive seizures. A marked granulocytosis was present at the time of death. At doses of 6,000 r there were equal numbers of the two types of death. Irradiation of the head alone produced similar effects. (auth)

1169

LARGE DOSES OF I^{131} IN DOGS. RADIATION DOSAGE CORRELATED WITH HISTOLOGIC AND AUTORADIOGRAPHIC CHANGES. Martin B. Levene, Gould A. Andrews, and Ralph M. Kniseley (Oak Ridge Inst. of Nuclear Studies, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 88-97(1955) Jan.

Normal dogs were given 1.5 millicuries per kilogram of I^{131}. A distinct time pattern of histopathologic changes was found, with morphologic evidence of inflammation and necrosis developing after the third day. Destruction of the gland was correlated with release of I^{131} from the thyroid into the blood stream. A patchy rim of preserved follicles was seen in the animals sacrificed on the sixth and ninth day intervals, and these follicles were shown by autoradiographic studies to have retained the radioisotope selectively. At later intervals necrosis was complete, and autoradiographs showed focal zones of radioactivity. (auth)

1170

MODIFICATION IN STEROL METABOLISM OF YEAST ORGANISMS UNDER THE INFLUENCE OF X RAYS. R. D. Gal'tsova, M. N. Meĭsel, and L. A. Seliverstova (Institute of Microbiology, Academy of Science, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 98, 1013-16(1954) Oct. 21. (In Russian)

Data on the ergosterol content, respiration, and fermentative power of Saccharomyces cerevisiae cultures following exposure to 2000 to 100,000 r of 160-kv x rays are tabulated and discussed. (G.Y.)

RADIOGRAPHY

1171

XERORADIOGRAPHY. John Faunce Roach (Albany Medical Coll., N. Y.) and Herman E. Hilleboe (New York State Department of Health, Albany). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 5-9(1955) Jan.

Xeroradiography is recommended as a simple, safe, and inexpensive medium for the recording of roentgen images. The same x-ray machine used for conventional roentgenography can be used in xeroradiography without any modifications; however, xeroradiography is fundamentally different from conventional roentgenography in that it is totally photoelectric in nature whereas standard film is chiefly photochemical in character. Since it is purely a photoelectric mechanism, no solution or liquid is required. Other advantages of the xeroradiographic process cited are the very brief time required and the excellent resolving power of the xeroplates. The process is described in detail and photographs of equipment and radiographs are included. The potentialities of using the process in both civil defense and diagnostic roentgenography are discussed. (C.H.)

RADIOTHERAPY

1172

DISTRIBUTION AND PATHOLOGY RESULTING FROM THE INTRACEREBRAL AND INTRAVENTRICULAR INJECTION OF RADIOACTIVE GOLD AND SILVER COATED RADIOGOLD COLLOIDS. C. C. McClure, Jr., E. L. Carothers, and P. F. Hahn (Meharry Medical Coll., Nashville, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 81-7 (1955) Jan.

Injection of radioactive gold colloids and silver coated radioactive gold colloids into the brain substance resulted in localization of the material roughly in proportion to the volume administered. When such colloids were injected into the lateral ventricle of the brain there was a diffuse parallel distribution of the colloid in both the right and left side with slight concentrations in some regions in the fore and hind part of the brain. There was a considerable concentration of the material in the choroid plexus but gross and histological examination of this structure did not show anything but minimal changes. The possibilities of the use of such inert colloids in treatment of malignant brain tumors and hydrocephalus are briefly discussed. (auth)

1173

BLOOD RADIATION DOSE DURING RADIOIODINE THERAPY OF METASTATIC THYROID CARCINOMA. S. M. Seidlin, A. Aaron Yalow, and Edward Siegel (Montefiore Hospital, New York). Radiology 63, 797-813(1954) Dec.

The blood radioiodine concentration was determined for periods of one to thirty-five days following ingestion of 69 oral therapeutic doses of I^{131} by 26 patients with metastatic thyroid carcinoma. Calculations are presented by means of which the specific radiation dose [rep/100 mc] to the blood and the total blood radiation may be computed from the area under the curve of specific blood radioiodine concentration [μc/gm/100 mc I^{131}] vs. time. It is shown that the generalized body radiation is about 50 per cent of that received by blood. The diagnostic and therapeutic significance of the specific radiation dose is discussed. (auth)

1174

RADIATION THERAPY WITH RADIOACTIVE COBALT-60. J. H. Pannell. Atomics 5, 329-32; 348(1954) Dec.

The application and techniques of interstitial Co^{60} therapy are discussed in relation to uses in pre- and postoperative cancer surgery. (K.S.)

1175

RADIOACTIVE ISOTOPES IN MANAGEMENT OF CARCINOMATOSIS OF SEROUS BODY CAVITIES. Edward M. Kent, Campbell Moses, William B. Ford, Eugene R. Kutz, and Robert S. George (Univ. of Pittsburgh School of Medicine and Allegheny General Hospital, Pittsburgh, Penna.). Arch. Internal Med. 94, 334-40(1954) Sept.

The use of radioactive colloidal gold in the management of carcinomatous effusions in the serous cavities is discussed. Favorable results have been observed in approximately one-half of a total group comprising 163 followed patients. The comparatively simple technique is described. Toxic manifestations have been quite mild and rather rare. The methods employed for the protection of involved personnel are shown. (auth)

TRACER APPLICATIONS

1176

Naval Radiological Defense Lab.

THE EFFECT OF BONE-MARROW INJECTION ON THE INCORPORATION OF FORMATE-CARBON-14 INTO DESOXYRIBONUCLEIC ACID PURINES OF X-IRRADIATED RATS. C. A. Erickson, R. K. Main, and L. J. Cole. Oct. 15, 1954. 32p. (USNRDL-TR-14)

This study tests the hypothesis that injection of bone-marrow suspension produces significant biochemical effects on nucleic acid components. The criterion used was the effect on the incorporation of formate-C^{14} into desoxyribonucleic acid purines of bone marrow, spleen, small intestine, and liver from x-irradiated rats. Injection of bone marrow causes an over-recovery of previously inhibited incorporation in the DNA purines of bone marrow and spleen on the eighth post-irradiation day. Results for the small intestine and liver were inconclusive. (auth)

1177

THE USE OF THE RADIOACTIVE ISOTOPE OF COBALT Co^{58} FOR THE PREPARATION OF LABELLED VITAMIN B_{12}. J. E. Bradley, E. Lester Smith, S. J. Baker, and D. L. Mollin (Postgraduate Medical School of London and Glaxo Labs., London, England). Lancet 267, 476-7(1954) Sept. 4.

The use of vitamin B_{12} labeled with Co^{58} instead of Co^{60} for the study of B_{12} adsorption from the intestine is recommended. Advantages are the increased safety due to the 72-day half-life of Co^{58}. Preliminary studies indicate similar excretion patterns for the two isotopes. Procedures for the formation of Co^{58} by the reaction Ni^{58} (n,p) Co^{58} are outlined. (C.H.)

1178

LOCALIZATION OF PROTEIN-BOUND I^{131} IN THE THYROID GLAND OF THE MOUSE. Seymour H. Wollman and Isidore Wodinsky (National Cancer Inst., Bethesda, Md.). Endocrinology 56, 9-20(1955) Jan.

Autoradiographic studies were made of the localization of protein-bound I^{131} in the thyroid gland of C3H mice between eleven seconds and one hour after radioiodide injection. The protein-bound I^{131} responsible for the autoradiographic image always appeared to be localized in the colloid. This suggested that the iodination of the thyroglobulin occurred in the colloid. At two minutes and earlier the protein-bound I^{131} in thyroid sections appeared to be localized in a narrow ring at the edge of the colloid. By ten minutes the ring distribution had become broad rings of uniform disks in most of the follicles, but the variation from follicle to follicle within a single gland suggested that the colloid was of variable viscosity from one follicle to another. Anesthesia with Veterinary Nembutal appeared to increase significantly the time interval required for rings to become disks or to increase the viscosity of the colloid. Occasionally, follicles yielded incomplete ring autoradiographs indicating non-uniform function. Some follicles did not accumulate detectable amounts of I^{131}. (auth)

1179

THE DIAGNOSTIC USE OF I^{132}. E. M. Hanbury, Jr., J. Heslin, L. G. Stang, Jr., W. D. Tucker, and J. E. Rall (Sloan-Kettering Inst., New York, N. Y. and Brookhaven National Lab., Upton, N. Y.). J. Clin. Endocrinol. and Metabolism 14, 1530-8(1954) Dec.

The application of I^{132}, with a half life of 2.33 hours, to previously designed tracer techniques is presented. Clinical data on 11 patients studied with I^{132} include 1-hour thyroidal uptake determinations and 30-minute thyroidal clearance rates. I^{132} would seem to find its chief merit in tracer experiments in which minimal radiation is desired and experiments in which frequent measurements of iodine uptake are desired. (auth)

1180

RENAL FUNCTION AND I^{131} CLEARANCE IN HYPERTHYROIDISM AND MYXEDEMA. Charles J. Hlad, Jr. and Neal S. Bricker (Veterans Administration Hospital; Fitzsimons Army Hospital; and Univ. of Colorado School of Medicine, Denver, Colo.). J. Clin Endocrinol. and Metabolism 14, 1539-50(1954) Dec.

A direct correlation was found between clearance of I^{131} and the glomerular filtration rate in hyperthyroid and myxedematous patients. (C.H.)

CHEMISTRY

1181

Institute for the Study of Rate Processes, Univ. of Utah.
THE REDUCTION OF METALS FROM AQUEOUS SOLUTIONS BY HIGH TEMPERATURE-HIGH PRESSURE TECHNIQUES. 1. COBALT AMINE IN HYDROGEN. Thomas M. Kaneko, W. Martin Fassell, Jr., and Milton E. Wadsworth. Dec. 1, 1954. 15p. Contract AT(11-1)-82, Technical Report No. 13. (AECU-2978)

The reduction rate of an ammoniacal solution of cobalt sulfate with hydrogen gas was found to be linear in the temperature range of 150 to 240°C under hydrogen over-pressure of 0 to 800 psia. An Arrhenius-type plot of the logarithm of the rate vs. reciprocal temperature was linear for a hydrogen over-pressure of 650 psia. The apparent activation energy determined from the slope of the plot was found to be 15.7 kcal per mole. (auth)

1182

Polytechnic Inst. of Brooklyn
A TREATMENT OF CERTAIN ISOTOPIC EXCHANGE REACTIONS HAVING COMPLEX MECHANISMS. R. A. Marcus. Dec. 1, 1954. 21p. Contract Nonr 839 (09), Technical Report No. 1. (NP-5446)

The reaction rate vs. time data of isotopic exchange reactions have been shown by previous work to obey a first order rate law, neglecting differences in isotopic reactivity. A simple method, of use in reactions having complex mechanisms, is developed for relating this first order rate constant to the rate constants of the elementary steps in the process. The method involves examining the progress of a given atom through the reaction sequence, and is applicable regardless of the number of exchange positions of the reactants, or of whether or not one isotope is present in trace amounts. These results are used to reinterpret some data on the deuteration of diborane. (auth)

1183

Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACHED ZONE MATERIAL. PROGRESS REPORT [FOR] DECEMBER 1954. Dec. 30, 1954. 11p. (RMO-2731)

In the production of nitric phosphate fertilizer from Florida leached zone ore, the ore is calcined and then extracted with nitric and sulfuric acids, uranium is recovered from the filtrate, and the filtrate is then ammoniated, granulated, and dried. Pilot-plant tests confirmed previous bench-scale tests which indicated that high loss of nitrogen during drying of the fertilizer product could be avoided by reducing the pH of ammoniation to 6 or lower. Preliminary pilot-plant tests were made with the new sample of leached zone ore. Ore that had been calcined at 2230° F. was extracted with acid and the resultant slurry was filtered. Filtration of this slurry and washing of the filter cake were unsatisfactory. Bench-scale tests indicated that substantially better results can be obtained with ore calcined at a lower temperature. Other bench-scale tests indicated that the procedures previously used for the ammoniation, granulation, and drying steps of the process will be satisfactory for processing the new sample of ore. (For preceding period see RMO-2730.) (auth)

1184

STUDY OF THE CHANGE OF THE APPARENT DENSITY OF CRUDE OXIDES. APPLICATION OF THORIUM OXIDE. Marc Foëx. Translated from Bull. soc. chim. France, D231-7(1949). 14p. (AEC-tr-1990)

The treatment at high temperatures of compressed specimens of raw oxides is accompanied by considerable contraction. In the case of thorium oxide this contraction (at less than 1000°) is essentially due to the increase of the apparent density of the grains making up the sample. From measurements of linear expansion the change in the apparent density of a compressed sample of thorium oxide at different temperatures is calculated. The result obtained in a series of isothermal experiments carried out at temperatures between 20 and 280° have permitted the determination of the change of the apparent density as a function of time. The analysis of the products with x rays shows that the observed contraction is linked to the growth of microcrystals of very small size initially constituting the raw thorium oxide. The rate of change of the phenomenon increases very rapidly with temperature; it likewise depends on the apparent density and with the variation with respect to the state of equilibrium which exists in well crystallized oxides of high density. The process of change in crystallization of thorium oxide appears to be present for numerous other materials capable of being obtained in the form of microcrystals. The method could permit the control of these materials with the object of getting products of large surface having well determined properties. (auth)

1185

THE HEAT OF FORMATION OF TITANIUM(III) CHLORIDE. Harald Schäfer, Günther Breil, and Gerhard Pfeffer. Z. anorg. u. allgem. Chem. 276, 325-32(1954) Aug. (In German)

The reaction of $TiCl_3 + \frac{1}{2} Cl_2 \rightarrow TiCl_4$ was completed in a calorimeter. Independent thereof the equilibrium of $TiCl_4 + Hg \rightarrow TiCl_3 + \frac{1}{2} Hg_2Cl_2$ was further investigated. The heat of formation of the violet $TiCl_3$ for first reaction was 161.1 kcal and the second 161.6 kcal. (tr-auth)

1186

ENTHALPY OF FORMATION OF LITHIUM ANTIMONIDE. S. A. Shchukarev, E. Vol'f, and M. P. Morozova (Leningrad State Univ.). Zhur. Obshchei Khim. 24, 1295-6(1954) Nov. (In Russian)

Heat of formation of Li_3Sb at 25°C was found to be −77.8 kcal/mole. (G.Y.)

1187

THEORY OF THE SELF-DIFFUSION OF WATER IN PROTEIN SOLUTIONS. A NEW METHOD FOR STUDYING THE HYDRATION AND SHAPE OF PROTEIN MOLECULES. Jui H. Wang (Yale Univ., New Haven, Conn.). J. Am. Chem. Soc. 76, 4755-63(1954) Oct. 5.

A theory is developed to treat quantitatively the self-diffusion of water in protein solutions. The result can be used to study the controversial problem of protein hydration from a new angle. The hydration of proteins computed from self-diffusion data by means of the present theory is independent of the molecular weight of the protein, and for proteins such as ovalbumin depends only slightly on molecular shape. The hydration of ovalbumin in its isoelectric salt-free solution at 10.0° is determined in the present work to be 0.18 ± 0.01 g of water per g of dry protein. By combining this value with the diffusion data for ovalbumin, the axial ratios of the equivalent ellipsoid of revolution for ovalbumin are calculated to be 2.6:1:1. These results are discussed and compared with some selected data from the dielectric absorption and low-angle x-ray scattering measurements for ovalbumin solutions. Existing data on the viscosity of ovalbumin solutions are also examined, and the usual interpretation of intrinsic viscosity is criticized. (auth)

1188

MEASUREMENT OF THE VAPOR PRESSURE OF SOLID ANTIMONY BY A TRACER METHOD. An. N. Nesmeyanov and B. Z. Iofa. Doklady Akad. Nauk S.S.S.R. 98, 993-5 (1954) Oct. 21. (In Russian)

The vapor pressure of solid Sb between 345 and 588°C, as determined by an effusion method utilizing Sb^{124} tracer, is tabulated, and the data are expressed by the equation log $P = -10508.603/T + 11.044$. The technique is described and illustrated. (G.Y.)

1189

EXPERIMENTS ON INVESTIGATION OF DIFFUSION OF SILVER AND LEAD IONS IN SILVER BROMIDE. A. Murin and B. Lur'e. Doklady Akad. Nauk S.S.S.R. 99, 53-5(1954) Nov. 1. (In Russian)

Ag^{110} and ThB (Pb^{212}) were used as tracers in this study. The diffusion data obtained are graphed and analyzed. (G.Y.)

1190

PAPER CHROMATOGRAPHY OF INORGANIC IONS. IX. A NOTE ON THE PREPARATION OF CARRIER-FREE ^{131}Cs. M. Lederer (Institut du Radium, Paris, France). Anal. Chim. Acta 11, 528-9(1954) Dec. (In English)

Carrier-free Cs^{131} was prepared by crystallization of the irradiated BaCl$_2$ and paper chromatography of the mother liquors with phenol saturated with 2N HCl. (auth)

1191

STUDIES ON COORDINATION COMPOUNDS. XII. CALCULATION OF THERMODYNAMIC FORMATION CONSTANTS AT VARYING IONIC STRENGTHS. Reed M. Izatt, Charles G. Haas, Jr., B. P. Block, and W. Conard Fernelius (Pennsylvania State Univ., State College). J. Phys. Chem. 58, 1133-6(1954) Dec.

Molarity quotients determined potentiometrically at varying ionic strengths have been converted to stepwise thermodynamic formation constants in aqueous solution for the reactions of Zn^{++}, Ni^{++}, Ce^{3+}, and Pr^{3+} (as the perchlorates) with the acetylacetonate ion at 30° by means of activity coefficients calculated from the Debye-Hückel equation. Agreement of the several thermodynamic constants calculated for each metal ion is good. The molarity quotients in the literature for the Pb^{++}-citrate and the Cu^{++}-, Ni^{++}-, Cd^{++}-, and Mg^{++}-malonate systems may be satisfactorily converted to thermodynamic constants by the same procedure. (auth)

1192

THE THORIUM-TELLURIUM SYSTEM. R. W. M. D'Eye and P. G. Sellman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc. (London), 3760-6 (1954) Nov.

From x-ray and chemical analysis, phase-rule considerations, and tensimetric studies the compounds ThTe, ThTe$_2$, ThTe$_{2.66}$, and ThOTe were identified. ThTe possesses primitive cubic symmetry, with one molecule per unit cell, and is not isostructural with ThS or ThSe. ThTe, in contrast to the corresponding sulfide and selenide which melt above 1800°C, is degraded well below 1000°C in vacuum. Owing to the apparent low symmetry of ThTe$_2$ and ThTe$_{2.66}$ complete crystal structure data have so far not been obtained. No telluride corresponding to Th$_2$X$_3$, Th$_7$X$_{12}$, or ThX$_{2.33}$ (where X = S or Se) was found and it would appear that the Th—Te system is not analogous to the Th—S or the Th—Se system. The ternary compound ThOTe is isostructural with ThOS and ThOSe; it is tetragonal with 2 molecules per unit cell. ThOTe is degraded when heated in vacuum into its constituents, whereas ThOSe melts without degradation at 2200°C. (auth)

1193

EXPERIMENTAL INVESTIGATION OF LAMINAR SYSTEMS XXI. EFFECT OF ELECTROLYTES ON FORMATION OF VERY THIN FILMS ON SURFACES OF COLLOID SUSPENSIONS OF TITANIUM AND THORIUM HYDROXIDES. S. G. Mokrushin and Z. G. Sheina (Kirov Ural Polytechnic Inst.). Kolloid. Zhur. 16, 376-80(1954) Sept.-Oct. (In Russian)

1194

THEORY OF THE PROCESS OF FORMATION OF THE ANODIC FILM ON ALUMINUM. I. V. Krotov (Institute of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 28, 1550-4(1954) Sept. (In Russian)

1195

EFFECT OF LITHIUM IONS ON THE ELECTRODEPOSITION OF COPPER. S. V. Gorbachev and R. M. Vasenin (Mendeleev Chemical Technology Inst., Moscow). Zhur. Fiz. Khim. 28, 1795-1803(1954) Oct. (In Russian)

ANALYTICAL PROCEDURES

1196

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

SPOT TESTS FOR CONTAMINANTS ON ALUMINUM. H. S. Hilborn and R. C. Pugh. Nov. 1954. 19p. Contract AT(07-2)-1. (DP-88)

The combination of electrolytic sampling with conventional colorimetric spot tests provides a convenient method for identifying small metallic inclusions in aluminum. Tests of particular interest are compiled for easy reference. Techniques are given for the identification of copper, iron, lead, magnesium, mercury, molybdenum, tin, and uranium on aluminum. Pinholes may be revealed in aluminum cladding by the detection of nickel or uranium substrates. (auth)

1197

Pitman-Dunn Labs., Frankford Arsenal

DETERMINATION OF OXYGEN IN TITANIUM AND TITANIUM ALLOYS. M. Codell and G. Norwitz. Aug. 20, 1954. 23p. (Includes an Addendum). (NP-5450; S-4128)

A new method is proposed for the determination of oxygen in titanium and titanium alloys. The sample is mixed with carbon and is treated with bromine vapor at 815°C in a Vycor tube, using helium as a carrier gas. The oxygen in the sample combines with the carbon to form carbon monoxide which is then oxidized to carbon dioxide with hot copper oxide. The carbon dioxide is absorbed into a weighed bulb containing Ascarite. An investigation was conducted concerning the most practical means for removing the titanium tetrabromide and bromine. The use of an ice bath followed by two dry ice—alcohol baths removed most of these substances. To remove the last traces of bromine and bromine compounds, the gases were passed through silver heated to 650°C. A blank of about

0.9 mg of carbon dioxide per hr (equivalent to about 0.33 mg of oxygen per hr) was deducted. The average run takes 1-½ to 2 hrs. The method differed on the average by 0.007% from the results obtained by the vacuum fusion method, and the standard deviation of the method was 0.009%. The standards available covered the range of 0.12 to 0.35% oxygen. The method seems readily applicable to the determination of oxygen over the range 0.05 to 0.5%. (auth)

1198

ABSORPTIOMETRIC DETERMINATION OF MAGNESIUM IN TITANIUM AND ITS ALLOYS. H. J. G. Challis and D. F. Wood (Imperial Chemical Industries, Ltd., Witton, Birmingham, England). Analyst 79, 762-70(1954) Dec.

Procedures have been established for the determination of magnesium in titanium and its alloys. For the examination of titanium metal the method involves the preliminary separation of titanium by extraction with cupferron—chloroform followed by the absorptiometric determination of magnesium, making use of Titan Yellow. Alluminium, chromium, and copper interfere, but modifications are described so that interference due to the amounts likely to be present is avoided. Tests have established that the Titan Yellow method is reliable and reproducible for magnesium contents between 0.02 and 1.0% and is more rapid and convenient for routine batch analysis than the conventional phosphate method, particularly for amounts of magnesium below 0.1%. In the analysis of titanium alloys, removal of titanium and alloying elements is necessary and is effected by separations involving the use of cupferron, zinc oxide—permanganate, and sodium hydroxide—cyanide. The final determination of magnesium is accomplished by the Solochrome Cyanine R.200 method. The recoveries have been good from synthetic solutions and a number of alloys. (auth)

1199

SEPARATION OF TITANIUM COMBINED WITH SPECTROPHOTOMETRIC DETERMINATION OF TITANIUM IN STEEL. Joseph R. Simmler, Karl H. Roberts, and Samuel M. Tuthill (Mallinckrodt Chemical Works, St. Louis, Mo.). Anal. Chem. 26, 1902-4(1954) Dec.

A new quantitative separation of titanium from titanium-bearing steels (0.05 to 1.0% titanium) was utilized as the basis of the procedure described. The titanium was coprecipitated with added zirconium when the zirconium was precipitated as the arsenate from a strongly acid (1N) solution. This technique separated titanium from the usual elements in steel and particularly from vanadium, molybdenum, and chromium. The titanium was then determined spectrophotometrically in the presence of zirconium as the peroxytitanium complex. (auth)

1200

ION EXCHANGE METHOD FOR DETERMINATION OF ALKALI METALS IN PRESENCE OF CALCIUM AND MAGNESIUM. Olof Samuelson and Eero Sjöström (Chalmers Tekniska Högskola, Gothenburg, Sweden). Anal. Chem. 26, 1908-10(1954) Dec.

A rapid and accurate method was evoloved for determining potassium, sodium, and lithium in the presence of calcium and magnesium. The method is based upon the ability of ethylenediaminetetraacetic acid (EDTA) to give stable chelates with calcium and magnesium in water—ethyl alcohol solutions. The bivalent metals are taken up in a column filled with a mixture of an anion exchange resin in the ethylenediaminetetraacetic acid form and the acetate form. The alkali metals appear in the effluent which is passed directly through a second column containing an anion exchanger in the free-base form. The alkali hydroxides obtained in the effluent after the second column are titrated with standard acid. The determination can be carried out in less than 2 hours. (auth)

1201

COMPLEXOMETRIC TITRATION OF BISMUTH. Kuang Lu Cheng (Univ. of Connecticut, Storrs). Anal. Chem. 26, 1977-8(1954) Dec.

A method for the complexometric titration of Bi by ethylenediaminetetraacetic acid at pH 1.5 to 2 is reported, using potassium iodide as the indicator, with a few metals causing interference. Controlled concentration when adding the indicator to avoid Bi precipitation was necessary. Bismuth can be titrated in the presence of large amounts of Pb. (J.A.G.)

1202

DETERMINATION OF HYDROFLUORIC ACID IN NITRIC—HYDROFLUORIC ACID MIXTURES. S. A. Long (Bell Aircraft Corp., Buffalo, N. Y.). Anal. Chem. 26, 1988-9(1954) Dec.

A procedure is described for the determination of hydrofluoric acid in nitric—hydrofluoric acid mixtures. After a specific gravity determination, the sample is treated with hydrogen peroxide, neutralized with sodium hydroxide, and titrated with standard aluminum chloride. (auth)

1203

ISOTOPIC ANALYSIS OF SOME GASEOUS BORON HYDRIDES BY THERMAL CONDUCTIVITY. W. S. Koski, P. C. Maybury, and Joyce J. Kaufman (Johns Hopkins Univ., Baltimore, Md.). Anal. Chem. 26, 1992-4(1954) Dec.

In the determination of deuterium in some partially deuterated gaseous boron hydrides, two approaches were satisfactory. In one, the hydrogenous material was completely decomposed, and the resulting hydrogen—deuterium mixture was analyzed by a thermal conductivity method. The hydrogen compounds of boron, carbon, and nitrogen were decomposed by passing the gas over hot uranium metal. A second approach was direct measurement of the thermal conductance without decomposition. Excellent results were obtained with very pure diborane and pentaborane. (auth)

1204

ACTIVATION ANALYSIS DETERMINES SODIUM CONTENT OF ALUMINUM ALLOYS. Robert C. Plumb and Ralph H. Silverman (Aluminum Company of America, New Kensington, Penna.). Nucleonics 12, No. 12, 29-31(1954) Dec.

NEUTRON-ACTIVATION-ANALYSIS principles and techniques, as applied to determining the sodium content of aluminum alloys, are presented. After outlining the procedure, details of the irradiation, chemical separation, and measurement steps are given. The precision and accuracy obtained and the problems overcome are presented. (auth)

1205

COULOMETRIC AND POLAROGRAPHIC DETERMINATIONS OF TRACE AMOUNTS OF LEAD. Thomas L. Marple and L. B. Rogers (Massachusetts Inst. of Tech., Cambridge). Anal. Chim. Acta 11, 574-85(1954) Dec. (In English)

A stationary mercury-plated platinum electrode in a rapidly stirred solution has been applied to the polarographic and coulometric determination of trace amounts of lead(II). Once the equipment has been assembled and calibrated, analyses of micromolar solutions can be completed in less than ten minutes each with a precision of about 5%.

The method avoids the lengthy preparation of reagent solutions and the tedious extractions encountered in the competitive dithizone procedure. Furthermore, it can handle more dilute solutions than those usually analyzed by dithizone, (i.e., as low as 10^{-6} M). The method should be equally applicable to a number of other heavy metal ions. (auth)

1206

POTENTIOMETRIC TITRATIONS IN LIQUID AMMONIA. VII. CHARACTERISTICS OF A "DIFFERENCE INDICATOR" ELECTRODE SYSTEM. George W. Watt and Donald M. Sowards (Univ. of Texas, Austin). J. Electrochem. Soc. 102, 46-51(1955) Jan.

Titration of ammonium bromide with potassium and with potassium amide in liquid ammonia has been followed potentiometrically using a "difference indicator" electrode system. It has been shown that neither the precision with which the end-point is detected nor the magnitude of the corresponding change in potential is appreciably influenced by variation in either the length or diameter of the reference electrode capillary. Data relative to the effect of the concentration of supporting electrolyte and the composition of the solution in the reference electrode compartment are presented and discussed. (auth)

1207

THE PRECIPITATION OF RADIUM WITH BARIUM SULFATE. H. Jucker and W. D. Treadwell. Helv. Chim. Acta 37, No. 7, 2002-10(1954). (In German)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1208

AN X-RAY STUDY OF THE SUBSTRUCTURE OF FINE-GRAINED ALUMINUM. Sigmund Weissmann and Doris L. Evans (Rutgers Univ., New Brunswick, N. J.). Acta Cryst. 7, 733-4(1954) Nov.

Details of the grain substructure of fine-grained aluminum have been revealed by the x-ray double-crystal diffractometer by means of a multiple-exposure technique. The data obtained are used to compute statistical parameters that are a measure of the angular tilt between adjacent subgrains and of the angular misalignment of the lattice within a subgrain. An interpretation of the observed data as functions of lattice bending is presented. (auth)

1209

THE STATUS OF THE β-URANIUM STRUCTURE. Charles W. Tucker, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). Acta Cryst. 7, 752-6(1954) Nov.

The non-centrosymmetric structure for β-uranium based on powder pattern data recently proposed by Thewlis and Steeple (Acta. Cryst. 7, 323(1954)) is compared with (probably) centrosymmetric structure of Tucker and Senio (Acta. Cryst. 6, 753(1954)), which was based on single-crystal data. It is shown that, when compared on an equal basis, the reliability factor for the two structures is the same, namely, 18%. Further, the Thewlis and Steeple structure, which leans heavily on the stronger reflections, clearly contradicts the moderate and weaker single-crystal intensity data of Tucker and Senio regarding certain critical reflections which establish the puckering of the subsidiary layers. Also, the z parameters of the Thewlis and Steeple structure for the main layers spoil the agreement obtained for the critical reflections by puckering the subsidiary layers, thus indicating that the centrosymmetric structure is more probably correct. The differences in bond lengths between the two structures are of the order of 0.3 A, and therefore the bonding is entirely different in the two structures. It is held that the bond lengths and valencies given by Thewlis and Steeple are, therefore, incorrect. The two structure determinations are discussed. (auth)

FLUORINE AND FLUORINE COMPOUNDS

1210

THE HYDRATED TETRAFLUORIDES OF URANIUM AND PLUTONIUM. J. K. Dawson, R. W. M. D'Eye, and A. E. Truswell (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc. (London), 3922-9(1954) Nov

The tetrafluorides of uranium and plutonium form two hydrates, the higher one having 2.5 molecules of water per metal atom and the lower one 2.0 molecules of water or less. Methods for their formation have been investigated. The lower hydrate is pseudo-cubic, a = 5.69 kX for the uranium and 5.63 kX for the plutonium compound, and the proposed structure is similar to that of uranium dioxide, the water molecules occupying vacant uranium sites and being hydrogen-bonded to the fluorine. Very little change of cell dimension was observed over the range of $UF_4,2H_2O$ to $UF_4,0.75H_2O$. The fluorination, at temperatures below 100°, of the dioxides with gaseous hydrogen fluoride gives the lower fluoride hydrate and a second product which may be $M(OH)F_3,HF$. (auth)

LABORATORIES AND EQUIPMENT

1211

Brookhaven National Lab.
AN ELECTRIC HEATER FOR THE VAN SLYKE-FOLCH CARBON COMBUSTION APPARATUS. L. V. Hankes. [nd]. 7p. (BNL-1831)

1212

Ames Lab.
OPERATING CHARACTERISTICS OF A CENTRIFUGAL EXTRACTOR. G. H. Beyer and F. M. Jacobsen. Nov. 26, 1954. 39p. Contract W-7405-eng-82. (ISC-548)

The operating characteristics of a Podbielniak Model 5000 centrifugal extractor, having a combined-stream capacity of 450 cc/min at 5000 rpm and a rotor holdup of 529 cc, were investigated. Variables studied were density difference, rotor speed, light-liquid-out pressure, flow rates, holdup, and number of stages. A technique for holdup determination that comprises displacing either phase in the extractor with the other phase is described and experimentally demonstrated. An equation useful in predicting flooding limits is verified. It is suggested that the effective values of the rotor dimensions in this equation be determined by the behavior of the extractor. A relationship among number of stages, light-liquid-out pressure and flow rate ratio is demonstrated by extracting boric acid from isoamyl alcohol with water. With only a few runs this relationship should permit one to map in a family of curves for a particular system and thus rapidly estimate optimum operating conditions. A procedure is outlined for applying the methods presented to other systems using similar extractors. First, the constants in an equation are estimated from holdup measurements in order to predict flooding limits. Then, a few extraction runs are made to estimate optimum operating conditions. (auth)

1213

Ames Lab.

HIGH TEMPERATURE LABORATORY FURNACES. D. R. Wilder. Dec. 1, 1954. 23p. Contract W-7405-eng-82. (ISC-551)

A guide and introduction to the literature describing high-temperature laboratory furnaces is presented. Each general type of construction is briefly analyzed, and design data given for some of the materials commonly employed. 129 references. (auth)

RADIATION CHEMISTRY

1214

ROLE OF OXYGEN RADICALS IN OXIDATIONS AND REDUCTIONS CAUSED BY IONIZING RADIATIONS. I. STUDY OF THE CEROUS—CERIC SYSTEM. M. Haissinsky, M. Lefort, and H. Le Bail. Translated from J. chem. phys. 48, 208-12(1951). 11p. (AEC-tr-1988)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 5-5593.

1215

ROLE OF OXYGEN RADICALS IN OXIDATIONS AND REDUCTIONS CAUSED BY IONIZING RADIATION. 2. THE MECHANISM OF REACTIONS ACCORDING TO ANALYSIS OF THE GASES PRODUCED. M. Lefort and M. Haissinsky. Translated from J. chim. phys. 48, 368-71(1951). 9p. (AEC-tr-1989)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-146.

1216

CHEMICAL PHYSICS—ASYMMETRY OF ACTION OF THE RADICALS H AND OH IN OXIDATION AND REDUCTION CAUSED BY IONIZING RADIATIONS. Moise Haissinsky and Marc Lefort. Translated from Compt. rend. 230, 1156-8(1950). 3p. (AEC-tr-1991)

Oxidations caused by ionizing radiations in aqueous solutions occur more readily than reductions, particularly in the case of α rays. The different behavior of H and OH radicals is due partly to the difference in their masses but primarily to the differences in valence between H and O. In OH reactions the products formed are usually oxidants, and only very stable molecules such as H_2O have no reactivity. (M.P.G.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1217

RELATIONSHIP BETWEEN THE STRUCTURE AND SPECTRA IN RARE EARTH COMPLEXES. Ludwig Holleck and Dietrich Eckardt. Z. Naturforsch. 9b, 274-5(1954) Apr. (In German)

During the preparation of rare earth complexes, the composition of NaNdY and NaNdZ (where Y is ethylene diamine-tetraacetate and Z is cyclohexandiamine-tetraacetate) can be obtained so that similar term splitting in different complexes depends on similar complex structure. (tr-auth)

1218

SOLUBILITY PRODUCTS OF OXALATES OF CERTAIN RARE EARTH ELEMENTS AND INSTABILITY CONSTANTS OF THEIR COMPLEX SULFATES. I. M. Korenman. Zhur. Obshchei Khim. 24, 1910-16(1954) Nov. (In Russian)

Data on La, Ce, Pr, and Nd salts are tabulated. (G.Y.)

SEPARATION PROCEDURES

1219

Ames Lab.

THE MEASUREMENT OF TRANSPORT NUMBERS IN PURE FUSED SALTS. Frederick R. Duke and Richard W. Laity. Nov. 22, 1954. 14p. Contract W-7405-eng-82. (ISC-543)

Transport numbers are here defined as the fractions of current carried by the ions relative to the bulk of the liquid. They are measured by means of a cell which has two electrode compartments separated by a porous membrane. The displacement of an air bubble in a capillary tube connecting the two compartments serves to indicate the volume changes occurring on electrolysis. These data combined with known density data are used to calculate the transport numbers, assuming the simplest formulas for the current-carrying ions. The use of the membrane is justified for fused $PbCl_2$ by showing that three very different membranes, of porous glass, porcelain, and asbestos, give substantially identical results, the indicated value of t_- being 0.75. (auth)

1220

ELECTROOSMOSIS IN PAPER ELECTROCHROMATOGRAPHY WITH ELECTRODE VESSELS. John L. Engelke, Harold H. Strain, and Scott E. Wood (Argonne National Lab., Lemont, Ill.). Anal. Chem. 26, 1864-8(1954) Dec.

A simplified apparatus has been designed for the study of electroosmotic and hydrostatic flow in filter paper. Under the conditions employed in electrochromatography and with the ends of the paper dipping into the electrolytic solution, there is a significant electroosmotic flow through the paper. This flow, determined with noncharged flow indicators such as hydrogen peroxide, varies with different lots of paper; it increases with electrical field strength and dilution of the electrolytic solution; it varies little with the compression of the paper, the amount of the solution in the paper, and the duration of electrolysis; and it is uniform throughout the paper. The flow due to hydrostatic pressure is proportional to the head. It decreases with the compression of the paper and the amount of water in the paper. The hydrostatic pressure equivalent to the electroosmotic pressure at 7.55 volts per centimeter is only about 0.3 mm of water per centimeter of the paper. Because of the difficulty in controlling these variable conditions, the electroosmotic flow could not be defined precisely in terms of these variable factors. In electrochromatographic separations, the electroosmotic flow is determined most precisely with flow indicators. (auth)

1221

ELECTROOMOSIS IN PAPER ELECTROCHROMATOGRAPHY WITH ELECTRODES ON THE PAPER. Scott E. Wood and Harold H. Strain (Argonne National Lab., Lemont, Ill.). Anal. Chem. 26, 1869-72(1954) Dec.

As aid to electrochromatographic investigations, the electroosmotic flow of lactic acid solutions in filter paper was studied with the electrodes fixed to the paper. The flow was determined by the movement of small zones of noncharged, nonsorbed indicators, as solutions of formaldehyde, hydrogen peroxide, thioacetamide, allylthiourea, and hydroquinone (all detectable by reduction of silver ions), and radioactive sucrose and dextran. With the electrodes on the paper and without reserve of the electrolytic solution, the electroosmotic flow was very small, and the flow rate decreased with the duration of the electrolysis. This small flow also decreased with an increase in the paper wetness, and increased with the paper length. In a given paper, the flow across any line transverse to the electrical field was generally uniform, but it varied with the distance from the electrodes. The small electroosmotic flow and the decrease of the rate of flow with continued electrolysis were correlated with the development of resistive forces. These complex forces apparently resulted from a small change in the distribution of the solution in the paper and possibly from reactions at the electrodes. (auth)

1222

ELECTRICAL MOBILITY OF PHOSPHATE IONS IN PAPER ELECTROCHROMATOGRAPHY. John L. Engelke and Harold H. Strain (Argonne National Lab., Lemont, Ill.). Anal. Chem. 26, 1872-4(1954) Dec.

The electrical mobility of phosphate ions was determined in phosphate solutions in paper with zones of radioactive phosphate as the migration indicator. This procedure, which eliminates solution boundaries, shows that the mobility of phosphate varies with the pH. The ions $H_2PO_4^-$ and HPO_4^{--} have nearly equal mobilities, whereas PO_4^{---} migrates almost four times as fast. The electroosmotic flow of the phosphate solutions also varies with the pH. In strongly acid solutions, it is toward the anode; in weakly acid and alkaline solutions, it is toward the cathode. (auth)

1223

ANALYTICAL SEPARATION OF RHENIUM AND MOLYBDENUM BY ION EXCHANGE. Villiers W. Meloche and A. F. Preuss (Univ. of Wisconsin, Madison). Anal. Chem. 26, 1911-14(1954) Dec.

An improvement has been made in the procedure (S. A. Fisher and V. W. Meloche, Anal. Chem. 24, 1100(1952)) for the separation of perrhenate from molybdate using Amberlite IRA-400 (ClO_4^-) wherein the volume of eluting agents and the time required were considerably reduced. Potassium oxalate is recommended for the separation and elution of the molybdate and perchloric acid for the subsequent elution of the perrhenate. (auth)

1224

SEPARATION OF COBALT AND ZINC BY LIQUID-LIQUID EXTRACTION. H. A. Mahlman, G. W. Leddicotte, and F. L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 26 1939-41(1954) Dec.

A rapid, simple, and sharp separation of cobalt and zinc suitable for routine application is discussed. From the data reported, a modification of the general liquid-liquid extraction system may readily be made to obtain quantitative or qualitative separation of cobalt and zinc from each other and from members of the first transition series. Two amines, methyldioctylamine and tribenzylamine, were investigated with xylene, chloroform, and trichloroethylene-immiscible organic diluents. The extractability of the elements was determined by the use of radionuclides. The data indicate that another practical application of liquid-liquid extraction for rapid separation of chemically similar elements has been made. (auth)

1225

SEPARATION OF ACTINIUM-ACTINIUM K(Fr^{223}) BY PAPER CHROMATOGRAPHY. Marguerite Perey and Jean-Pierre Adloff. Compt. rend. 239, 1389-91(1954) Nov. 22. (In French)

A simple and efficient procedure for separating Fr^{223} from Ac has been developed, using paper chromatographic techniques. (K.S.)

SORPTION PHENOMENA

1226

ANION-EXCHANGE STUDIES. XI. LEAD(II) AND BISMUTH(III) IN CHLORIDE AND NITRATE SOLUTIONS. Frederick Nelson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 76, 5916-20(1954) Dec. 5.

The adsorbability of Pb(II) and Bi(III) from hydrochloric acid (0.25 to 12M HCl), nitric acid (0.5 to 10M HNO_3) and ammonium nitrate (1 to 10M) solutions was studied with a strong base quaternary amine anion-exchange resin. Lead was weakly adsorbed at low HCl concentrations (distribution coefficient D = 1 in 0.05M HCl), reached maximum adsorption (D = ca. 25) near 1 to 2M HCl, and then showed decreasing adsorption at higher HCl concentrations. Bi(III) adsorbed strongly throughout the HCl concentration range studied; D decreased with increasing HCl concentration from 2×10^5 (0.25M HCl) to 60 (12M HCl). Both lead and bismuth showed some adsorption in HNO_3 solutions, although this adsorption was considerably smaller than in HCl solutions. In NH_4NO_3 solutions adsorption of lead remained low but for bismuth it increased to D = ca. 200 in 10M NH_4NO_3. Typical separations involving Pb(II) and Bi(III) in these media are illustrated. (auth)

SPECTROSCOPY

1227

THE BLUE BAND-SYSTEM OF NIOBIUM OXIDE. Ulla Uhler (Univ. of Stockholm, Sweden). Arkiv Fysik 8, No. 3, 265-79(1954).

A new rotational analysis of the blue band system of niobium oxide has been carried out. The bands are shaded to the red and represent a $^2\Delta - ^2\Delta$ transition ($A^2\Delta - (X)^2\Delta$). Both $^2\Delta$ states show a moderate multiplet splitting and have large γ values. The 0,0, 0,1, 1,2, 1,0, 2,1, 2,0, and 3,1 bands have been analyzed. The band origins are represented by a relation, and the rotational analyses are given. (auth)

1228

THE ROTATIONAL ANALYSIS OF THE α AND γ SYSTEMS OF ZIRCONIUM OXIDE. A. Lagerqvist, U. Uhler, and R. F. Barrow (Univ. of Stockholm, Sweden and Univ. of Oxford, England). Arkiv Fysik 8, No. 3, 281-93(1954).

New rotational analyses of the 0,0 bands of the α and γ systems of ZrO have been made. Earlier analyses, which led to an improbably small value of the internuclear distance, appear to be incorrect. The values of the constants derived are given. The nature of the electronic states is discussed; it is concluded that states X and C are $^3\Delta$, state A $^3\Phi$. (auth)

TRACER APPLICATIONS

1229

THE SELF-DIFFUSION COEFFICIENTS OF WATER AND OVALBUMIN IN AQUEOUS OVALBUMIN SOLUTIONS AT 10°. Jui H. Wang, Christian B. Anfinsen and Francesco M. Polestra (Yale Univ., New Haven, Conn. and National Heart Inst., Bethesda, Md.). J. Am. Chem. Soc. 76, 4763-5(1954) Oct. 5.

The self-diffusion coefficients of water and ovalbumin in aqueous ovalbumin solutions at 10° have been determined with H_2O^{18} and C^{14}-labeled ovalbumin, respectively, as the tracers. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1230

THE OXIDATION OF AMERICIUM TO THE SEXAVALENT STATE. M. Ward and G. A. Welch (Windscale Works, Cumberland, England). J. Chem. Soc. (London), 4038-9 (1954) Nov.

The oxidation of travalent Am to the hexavalent state in nitric acid by ammonium persulfate with additions of $AgNO_3$ at 85 to 90°C is briefly discussed. Experimental procedures and results are given. In addition, partial oxidation of tracer amounts by the addition of iodic acid and by the passage of O_3 into Am solutions in nitric acid was achieved. (J.A.G.)

URANIUM AND URANIUM COMPOUNDS

1231

Argonne National Lab.
THE HEAT CAPACITY OF URANIUM TETRAFLUORIDE FROM 5 TO 300°K. D. W. Osborne, E. F. Westrum, Jr., and H. R. Lohr. Nov. 1954. 11p. Contract W-31-109-eng-38. (ANL-5365)

The heat capacity of a pure sample of uranium tetrafluoride was determined from 5 to 300°K and found to be at variance with measurements by Brickwedde, Hoge, and Scott. The new data make possible a better evaluation of the magnetic entropy above 5°K and suggest the probability of a thermal anomaly below 5°K. The values of C_p, $H^0-H_5^0$, and $S^0-S_5^0$ are 27.73 ± 0.03 cal deg^{-1} $mole^{-1}$, 5389 ± 6 cal $mole^{-1}$, and 36.13 _ 0.04 cal deg^{-1} $mole^{-1}$, respectively, at 298.16°K. (auth)

1232

POLAROGRAPHIC DETERMINATION OF URANIUM IN ORES IN ASCORBIC ACID SUPPORTING ELECTROLYTE. M. Šušić, I. Gal, and E. Cuker (Inst. of Nuclear Sciences "B. Kidrič", Belgrade, Yugoslavia). Anal. Chim. Acta 11, 586-9(1954) Dec.

A polarographic determination of uranium in ores using 0.5M l-ascorbic acid as supporting electrolyte is described. Four different ores were analyzed, and the results compared with those obtained by other analytical methods. No previous chemical separations were necessary. The method is simple, rapid, and seems to be suitable for routine analyses of samples with a uranium content above 0.01%. In the concentration range 0.01 to 0.05%, the relative error of determination is 9 to 5%; above 0.05% U the precision is much U greater. Te, Tl, and Pb interfere in this method under the conditions described (pH 3.5 to 4.0), but the interference due to lead is eliminated in many cases by lowering the pH of the solution. (auth)

1233

AGES OF URANINITES BY A NEW METHOD. B. Wasserstein (Geological Survey, Pretoria, England). Nature 174, 1004-5(1954) Nov. 27.

The calculation of the ages of uraninites using the radioactive decay of the smaller atoms of tetravalent Pb within the crystal lattice is discussed. A shrinkage in the cell proportionate to time was found to occur. Artificial UO_2 was used as an end point to denote zero time. The uraninites were found to occur in three different classifications. These were given the designations α,β, and γ uraninites which correspond to U_4O_7, UO_2, and U_3O_7, respectively. The effects of various forces of nature on each are given along with their properties. Corrections for ThO_2 were made, and x-ray studies of thorianites are reported. (J.A.G.)

WASTE DISPOSAL

1234

Brookhaven National Lab.
ULTIMATE DISPOSAL OF RADIOACTIVE WASTES. L. P. Hatch, J. J. Martin, and W. S. Ginell. Feb. 1954. 31p. (BNL-1781)

Results are reported from laboratory experiments on the take-up of fission products on montmorillonite clay. Synthetic fission product solutions with tracer amounts of radioactive fission products added were used in the study. It was found that high concentrations of hydrogen, sodium, or ammonium ions are detrimental to the take-up of fission products on the clay. Best results were obtained on acidic wastes following acid removal by means of anion exchange, electrolysis, or distillation. Investigations of anionic adsorptive properties are incomplete, however the long-lived activities are generally associated with cations. Advantages of the clay include its capacity and selectivity as a cation exchanger, its relatively low cost, its ease of process handling, and its chemical and physical stability before and after heating to high temperature. (C.H.)

1235

Mound Lab.
THE USE OF SEQUENTIAL FACTORIAL DESIGNS IN THE ESTABLISHMENT OF OPTIMUM CONDITIONS FOR A DECONTAMINATION PROCESS. M. K. Barnett, P. M. Hamilton, and F. C. Mead, Jr. Jan. 11, 1954. 24p. Contract AT-33-1-GEN-53. (MLM-921)

The advantages of factorial design are first illustrated by a simple experiment devoted to the effect of two pH factors and an iron concentration factor on the efficiency of a decontamination process employing iron sulfide as a scavenging agent. The broadening of the base of an investigation by the expansion of a factorial is illustrated by addition of the sulfide concentration as a factor. Finally, the principle of expanded factorials is further utilized in the later phases of the study in which additional levels are assigned to the pH factors in order to arrive at a closer estimate of the optinum conditions for the process. (auth)

ENGINEERING

1236

Mound Lab.
MEASUREMENT OF THE DISTRIBUTION OF THIN LAYERS OF ALPHA-EMITTING MATERIALS. (INFORMATION REPORT). A. W. Wotring, R. G. Olt, and T. E. Eyles. Feb. 16, 1953. 22p. Contract AT-33-1-GEN-53. (MLM-818)

A method and apparatus for nondestructive measurement of the distribution of layers of alpha-active material have been developed. The method consists of measuring nuclear radiation from the sample, the number of alpha particles emitted per unit area of the sample being used as a measure of the quantity of material. The apparatus consists of a counter unit which makes quantitative measurements in narrow paths across the sample surface and a photographic unit which makes qualitative measurements of a much larger surface. Layers of alpha-active material from 5 to

10 mg/cm^2 in thickness can be measured with an accuracy of 3%. Measurements require approximately 2 hours. The method as described determines thickness by measurement of alpha-particle radiation, but other radiation may be used. Some of the features of this method may be applied to the solution of other problems. (auth)

HEAT TRANSFER AND FLUID FLOW

1237

Poulter Labs., Stanford Research Inst.
THE MECHANISM OF FLOW IN CONDENSED PHASES. Eugene F. Poncelet. Feb. 15, 1954. 20p. Contract DA-04-200-ORD-257, Technical Report No. 1. (AD-29642)

The application of the theory of elasticity to the physical concept of the nature of condensed phases yielding a complete understanding of the mechanism of flow and of various phenomena associated with it, such as rate of flow and viscosity, without requiring any assumptions such as the presence of internal friction is presented. (J.A.G.)

1238

INVESTIGATION OF HEAT EXCHANGE BY BOILING LIQUIDS IN TUBES. L. S. Sterman. Zhur. Tekh. Fiz. 24, 2046-53(1954) Nov. (In Russian)

Experimentally determined effects of pressure, steam content, and velocity on the heat-transfer coefficient and other properties of boiling water are plotted. Five figures. (G.Y.)

1239

APPROXIMATE INTEGRATION OF EQUATIONS OF PLANE TURBULENT SUPERSONIC GAS FLOW. I. Z. Kalishevich. Doklady Akad. Nauk. S.S.S.R. 99, 37-40(1954) Nov. 1. (In Russian)

1240

STRUCTURE OF THE CAVITATION REGION. K. K. Shal'nev (Moscow). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 5, 119-46(1954) May. (In Russian)

This extensive report of investigations on cavitation phenomena includes reproductions of motion pictures of the cavitation process. The experimental loop is illustrated, and the many data are graphed. 31 figures. 33 references. (G.Y.)

1241

PRESSURE AND EROSION IN THE REGION OF COLLAPSE CAVITATION OF CIRCULAR CROSS SECTION. K. K. Shal'nev (Moscow). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 6, 111-20(1954) June. (In Russian)

1242

INVESTIGATION OF THE EFFECT OF PRESSURE ON THE HEAT TRANSFER COEFFICIENT IN BOILER TUBES. F. F. Bogdanov (Moscow). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 6, 137-44(1954) June. (In Russian)

Data on effects of 2 to 160 atm pressure over the range 50,000 to 400,000 kcal/m^2/hr with circulation velocities from 0.5 to 2.5 m/sec are presented and analyzed. The experimental apparatus is illustrated. (G.Y.)

1243

THE STREAMLINE PROFILE IN TRANSONIC FLOW. A. F. Kryuchin (Riga). Priklad. Mat. i Mekh. 18, 547-60(1954) Sept.-Oct. (In Russian)

The problem is treated mathematically. (G.Y.)

1244

FLOW AROUND A THIN WEDGE IN SLIGHTLY SUPERSONIC FLOW OF AN IDEAL GAS. S. K. Aslanov (Saratov) Priklad. Mat. i Mekh. 18, 561-72(1954) Sept.-Oct. (In Russian)

1245

EQUATIONS, TABLES, AND CHARTS FOR COMPRESSIBLE FLOW. REPORT 1135. Ames Research Staff, Ames Aeronautical Lab., Moffett Field, Calif. Washington, D. C., Government Printing Office, 1953. 69p. $0.55.

A compilation of equations, tables, and charts useful in the analysis of high-speed flow of a compressible fluid is presented. The equations provide relations for continuous one-dimensional flow, normal and oblique shock waves, and Prandtl-Meyer expansions for both perfect and imperfect gases. The tables present useful dimensionless ratios for continuous one dimensional flow and for normal shock waves as functions of Mach number for air considered as a perfect gas. One series of charts presents the characteristics of the flow of air (considered a perfect gas) for oblique shock waves and for cones in a supersonic airstream. A second series shows the effects of caloric imperfections on continuous one-dimensional flow and on the flow through normal and oblique shock waves. (auth)

WASTE DISPOSAL

1246

OCEAN DISPOSAL OF RADIOACTIVE WASTE. Nucleonics 12, No. 12, 54(1954) Dec.

Techniques for disposal of both packaged and free radioactive wastes into the ocean are recommended. The water should be at least 6,000 ft. deep, and the wastes should be in a form that will sink. Methods of enclosing the wastes for disposal are discussed. International regulation of disposal should be authorized. (M.P.G.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1247

Ames Lab.
A STUDY OF THE REACTION OF THORIUM WITH SOME PURE REFRACTORY COMPOUNDS. G. R. Pulliam and E. S. Fitzsimmons. Dec. 10, 1954. 16p. Contract W-7405-eng-82. (ISC-550)

The effect of thorium metal on various refractory compounds was studied. The penetration of molten thorium into the ceramic was studied by microscopic examination of polished specimens. The reaction of powder mixtures heated to temperatures ranging from 1000 to 1800°C was studied by x-ray-diffraction patterns. Stabilized ZrO_2 proved to be the least reactive with massive thorium of those compounds studied. (auth)

1248

Lewis Flight Propulsion Lab., NACA
FABRICATION AND PROPERTIES OF HOT-PRESSED MOLYBDENUM DISILICIDE. Roger A. Long. Aug. 24, 1950. 34p. (NACA-RM-E50F22)

Hot-pressed molybdenum disilicide bodies produced by industrial methods and sources were evaluated. The outstanding characteristics reported are an elevated-temperature (2400°F) short-time tensile strength of 41,070 psi and a 100-hour rupture stress at 1800°F in excess of 30,000 psi as indicated in a preliminary evaluation. The material evaluated was extremely resistant to air corrosion up to 2850°F and generally brittle at temperatures below 2200°F. (auth)

1249

Lewis Flight Propulsion Lab., NACA
PRELIMINARY INVESTIGATION OF THE HEAT-SHOCK RESISTANT PROPERTIES OF MOLYBDENUM DISILICIDE BLADES UNDER CENTRIFUGAL LOAD. Roger A. Long and John C. Freche. May 6, 1952. 15p. (NACA-RM-E52A17)

An investigation to determine the heat-shock resistant properties of two MoSi$_2$ turbine blades under centrifugal loads imposed by turbine rotation is presented. MoSi$_2$ turbine blades fabricated by hot-pressing techniques withstood heat-shock conditions under blade centrifugal stresses up to 5350 psi. Additional development is required before the heat-shock resistant properties of MoSi$_2$ are satisfactory for turbine-blade application. (auth)

1250

Lewis Flight Propulsion Lab., NACA
SOME FACTORS AFFECTING FABRICATION AND HIGH-TEMPERATURE STRENGTH OF MOLYBDENUM DISILICIDE. W. A. Maxwell. Apr. 17, 1952. 25p. (NACA-RM-E52B06)

It has been demonstrated that the short-time high-temperature strength of sintered MoSi$_2$ can be greatly improved by carbon addition. Improved long-time deformation properties and decreased high-temperature plasticity accompany the carbon additions. These changes are attributed to partial deoxidation by the carbon. Large-grain hot-pressed MoSi$_2$ having a low oxygen content was found to have superior long-time properties. Hardness and other properties were found to be variable over a wide range. (auth)

1251

Lewis Flight Propulsion Lab., NACA
SOME STRESS-RUPTURE AND CREEP PROPERTIES OF MOLYBDENUM DISILICIDE IN THE RANGE 1600° TO 2000°F. W. A. Maxwell. June 24, 1952. 19p. (NACA-RM-E52D09)

An investigation of the stress-rupture and creep properties of hot-pressed MoSi$_2$ has produced the following results: 1. The long-time strength of MoSi$_2$ at high temperatures is superior to that of the high-temperature alloys and titanium carbide ceramals. 2. The use of MoSi$_2$ above 1800°F may be limited by the creep rate rather than by the stress-rupture life. 3. A comparatively convenient and satisfactory method for creep and stress-rupture testing to 2000°F has been developed. (auth)

1252

National Bureau of Standards
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 5. THE THERMAL CONDUCTIVITY OF MOLYBDENUM DISILICIDE FROM 300° TO 800°C. E. D. West, D. A. Ditmars, and D. C. Ginnings. Aug. 1954. 23p. Contract AF33(616) 52-10. (WADC-TR-53-201(pt. 5))

A new apparatus is described for determining at high temperatures the thermal conductivities of liquids and solids having realtively high conductivities. The apparatus employs steady state longitudinal heat flow along a rod surrounded by a matched guard tube. Results on molybdenum disilicide are described. (auth)

1253

CERAMIC COATINGS FOR USE IN NUCLEAR REACTORS. National Bureau of Standards. J. Franklin Inst. 258, 503-4 (1954) Dec.

Boron-free coatings for alloys in which a high-barium frit is combined with ceric-chromic oxides have been developed to withstand temperatures in excess of the 1000°C found in nuclear reactors. The computed neutron absorption coefficients are in the range of 0.15 to 0.50 barn. In extended heating tests some corrosion occurred beneath the coating, but the amount and depth of "stringer" corrosion was markedly reduced. The best coatings withstood the thermal shock encountered when quenched from 2000°F in water at room temperature. (M.P.G.)

CORROSION

1254

Mine Safety Appliances Co.
REPORT NO. 7, MARCH 1, 1954 THRU MAY 7, 1954 TO THE DETROIT EDISON COMPANY. J. R. Taylor, S. J. Rodgers, and H. J. Williams. July 25, 1954. 37p. (NP-5449)

A 30-day test on Zr tubing produced a metallic deposit on a large portion of the outer or NaK contacting surface. The deposit was found to be very magnetic, and a chemical analysis showed that it was 75% Fe. The deposit formation was believed to have been caused by a form of mass transfer due to the coexistence of a temperature differential and metals (type-316 stainless steel) having temperature-dependent solubilities in NaK. Weight and dimensional determinations made on the specimen tube before and after exposure showed no appreciable gain or loss of weight nor change in wall thickness. A metallurgical examination of the exposed Zr specimen showed the presence of black needle-like spider-web constituent which appeared to be at the grain boundaries penetrating to as much as half the thickness of the tube from the Na contacting side. This constituent was thought to be Zr hydrides. An examination by polarized light showed that recrystallization took place in all sections of the tube. A change in grain structure on the Na contacting surface was also evident with polarized light. An examination of the type-347 stainless steel IHX tube showed no erosion or corrosion and the tube structure was normal. An average concentration of 1.8 ppm of Zr at the sampling temperature was found in metal samples taken from the Na stream during the test. A total of less than 1 mg of Zr was found in Na and NaK cold traps analyzed at the conclusion of the tests, indicating that the amount of tube material lost to the liquid metals during the 30-day test was negligible. (J.A.G.)

1255

CORROSION OF TITANIUM IN FUSED CHLORIDES. FORMATION OF PYROSOLS. C. B. Gill, M. E. Straumanis, and A. W. Schlechten (Univ. of Missouri, Rolla). J. Electrochem. Soc. 102, 42-5(1955) Jan.

Titanium was severely attacked when immersed in a molten alkali chloride bath in the presence of air. The most severe corrosion of this metal was observed in molten NaCl–NaF mixtures; samples disintegrated completely at temperatures of 850°C in less than 3 hr. Progressively less corrosion occurred in KCl, NaCl, and LiCl melts. In many cases, salt fumes were more corrosive than the molten salt itself, evidently because of the better access of oxygen to the titanium surface. The corrosion rate fluctuated greatly from test to test but was very low in experiments performed in vacuum. The chief corrosion products were a dispersion of metallic titanium in the molten salt ("pyrosols"), mixed with some titanium oxides. The mixture was dark gray, and colored the solid salt bluish-black. White to yellowish oxides appeared in small amounts on the surface of the salt bath and consisted mainly of TiO_2. (auth)

GEOLOGY AND MINERALOGY

1256

Grand Junction Operations Office, AEC
RECONNAISSANCE OF THE LOWER CHINLE ALONG THE COLORADO RIVER BETWEEN THE MOAB AND DEWEY BRIDGES, GRAND COUNTY, UTAH. K. J. Rogers. Oct. 4, 1954. 18p. (RME-70)

The sandstones and conglomerates contained in the Shinarump conglomerate stratigraphic level in the area along the Colorado River between the Moab and Dewey bridges have been assigned to the lower Chinle. One small anomaly was located, but no favorable radioactive areas were found. Gray-green mudstone and siltstone zones and carbonaceous material are absent. (auth)

1257

Division of Raw Materials, AEC
PRELIMINARY REPORT ON URANIUM OCCURRENCE IN THE AUSTIN AREA, LANDER COUNTY, NEVADA. Byron J. Sharp and Donald L. Hetland. May 1954. 16p. (RME-2010)

Uranium mineralization was discovered about three miles south of Austin, Nev. The area is on the southern fringe of the Reese River silver mining district. Uranium occurs in mineralized fracture zones in a quartz monzonite intrusive and contact sedimentary rocks. The mineralized zones are usually associated with fine-grained siliceous dikes, vein quartz, and iron oxide staining. Metatorbernite and autunite are the principal uranium minerals in the oxidized zones. Select samples from the area contained as high as 6% U_3O_8, and an ore pile extracted from underground workings contained an average value of 0.151% U_3O_8. Prospecting should be concentrated on the mineralized zones in the intrusive rocks and adjacent metamorphosed sedimentary rocks. Exploration along these zones on the surface and at depth should further evaluate the quantity and quality of uranium ore which could be produced from the area. (auth)

1258

THEORY OF PROSPECTING WITH ELECTROMAGNETIC TRANSIENTS. Arnaldo Belluigi. Translated by E. R. Hope from Riv. geofis. appl. 14, 3-13(1953). 15p. (AEC-tr-1966)

1259

CAUSTIC SODA FUSION OF ZIRCONIUM ORES. H. L. Gilbert, C. Q. Morrison, A. Jones, and A. W. Henderson. U. S. Bur. Mines. Rept. Invest. 5091, Dec. 1954. 31p.

Zircon sand may be reacted with sodium hydroxide at 600°C to form sodium zirconate and sodium silicate. Sodium zirconate is water insoluble and may be washed free of sodium silicate. The sodium zirconate may then be converted to zirconyl chloride by the action of hydrochloric acid and the zirconyl chloride crystals separated by cooling the solution. This approach produces zirconyl chloride of satisfactory purity with less cost than is involved in buying anhydrous zirconium chloride and converting it. A proposed design for a plant is given. (auth)

1260

RADIOACTIVE DEPOSITS OF NEVADA. T. G. Lovering. U. S. Geol. Survey Bull. 1009-C, 1954. 106p. $0.20

Thirty-five occurrences of radioactive rocks had been reported from Nevada prior to 1952. Of those investigated, uranium minerals were identified at 13 sites; two sites contained a thorium mineral (monazite); the source of radioactivity on nine properties was not ascertained, and one showed no abnormal radioactivity. Of the other reported occurrences, one is said to contain uraniferous hydrocarbons, and nine are placers containing thorian monazite. Pitchblende occurs at two localities, the East Walker River area and the Stalin's Present prospect, where it is sparsely disseminated in tabular bodies cutting grantic rocks. Other uranium minerals found in the state include: carnotite, tyuyamunite, autunite, torbernite, gummite, uranophane, kasolite, and an unidentified mineral which may be dumontite. Monazite is the only thorium mineral of possible economic importance that has been reported. From an economic standpoint, only four of the properties examined showed reserves of uranium ore in 1952; these are: the Green Monster mine, which shipped 5 tons of ore to Marysvale, Utah, during 1951; the Majuba Hill Mine; the Stalin's Present prospect; and the West Willys claim in the Washington district. No estimate has been made of thorium reserves and no commercial deposits of thorium are known. (auth)

1261

PRELIMINARY REPORT ON URANIUM IN THE GAS HILLS AREA, FREMONT AND NATRONA COUNTIES, WYOMING. J. D. Love. U. S. Geol. Survey Circ. 352, 1954. 11p.

Uranium minerals have been discovered in the Wind River formation of early Eocene age, in strata of middle and late Eocene age, and in the Thermopolis shale of Early Cretaceous age in the Gas Hills area of central Wyoming. Geologists of the Atomic Energy Commission have made evaluation studies of many of the occurrences in the area as well as reconnaissance that led to new discoveries. The uranium is concentrated in clayey and conglomeratic sandstone and in carbonaceous shale. Sevaral selected samples of sandstones in the Wind River formation, taken for mineral determination, contain more than 10% uranium. The highest analysis of a channel sample is 6.72% uranium from a 1-ft section of conglomeratic sandstone in the Wind River formation. The highest analysis of a carbonaceous shale in this formation is 0.062% uranium. A sample of sandstone from the sequence of middle and late Eocene age contained 0.078% uranium. A sample from the Thermopolis shale directly overlain by the Wind River formation contained 0.041% uranium. Several uranium minerals are present. The dominant one is meta-autunite, $Ca(UO_2)_2(PO_4)_2 \cdot 2\frac{1}{2}\text{-}6\frac{1}{2}H_2O$, a pale greenish-yellow highly fluorescent mineral. In some samples, arsenic appears to be more abundant than phosphorus and the mineral may be uranospinite, $Ca(UO_2)_2(AsO_4)_2 \cdot 8\text{-}12H_2O$. A greenish-yellow nonfluorescent mineral is present in several localities. X-ray studies indicate that it is a calcium uranyl phosphate, possibly a new mineral. It is believed that the source of the uranium may have been tuff in the White River formation (Oligocene) or younger Tertiary rocks that once overlay this portion of the Wind River Basin. The available evidence suggests that the uranium was carried downward and laterally along sandstone aquifers in the middle Eocene sequence and Wind River formation and was concentrated in favorable host rocks. (auth)

1262

PRELIMINARY GEOLOGIC MAP OF THE RED CANYON QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 17. E. J. McKay. Washington, U. S. Geological Survey, 1954.

METALS AND METALLURGY

1263

General Engineering Lab., General Electric Co.
NON-DESTRUCTIVE INSPECTION OF ADHESIVE BONDED SHEET METAL. INTERIM MONTHLY PROGRESS REPORT NO. 21, [FOR] MARCH 1, 1954—APRIL 1, 1954. E. Niemann, Jr. Apr. 13, 1954. 13p. Contract AF33(600) 17322. (AD-31584)

The Branson audigage was found to be a good means for finding faulty bonds in lap joints with adhesives when they are caused by the following process failures: low pressure during curing which causes thick porous bonds; voids due to the absence of adhesive; partial curing before bonding caused by maintaining the bond at an elevated temperature before bonding for sufficient time that partial curing occurs; and undercuring which is obtained when bonding takes place at a low bonding temperature for an insufficient time. Advantages and disadvantages of the equipment are given, and characteristics of the bonded joints are reported. (For preceding period see AD-28855.) (J.E.D.)

1264

Naval Engineering Experiment Station, Annapolis
EVALUATION OF WELDED JOINTS BETWEEN AISI 347 STAINLESS STEEL AND 70/30 COPPER—NICKEL ALLOY TUBES UNDER THERMAL SHOCK, MARK II. W. E. Clautice. Aug. 27, 1954. 26p. (EES-060088a)

Thermal shock tests were performed for a mockup representing welded bimetallic joints uniting components in emergency heat exchangers in newly developed submarine propulsion plants. In their present state of development, they are considered unsatisfactory for use in the naval service. (auth)

1265

Tennessee Univ.
DECOMPOSITION OF EUTECTOIDS IN ALLOY SYSTEMS [thesis]. EIGHTH QUARTERLY STATUS REPORT AND FIRST INTERIM TECHNICAL REPORT, SEPTEMBER 1, 1953 TO AUGUST 31, 1954. R. E. Pawel. 106p. Contract DA-33-008-Ord-491. (NP-5444)

A potentially abnormal iron—carbon alloy may be normalized by alloy addition, deoxidizers such as aluminum being more potent normalizers than the more noble metals. The presence of a pro-eutectoid carbide phase seems essential for the formation of the abnormal structure, as no abnormality was noticed in apparent eutectoid zones. Austenitizing time, temperature, or cooling cycle above the transformation temperature does not grossly affect the abnormal properties, with the exception of grain size factors. A small grain size yields a greater degree of abnormality for a given heat treatment. In slow-cool transformation, the cooling rate through the reaction zone exhibits a profound effect upon the final structure, the slower rates yielding the more abnormal structures. In isothermal transformation, the temperature of transformation of the potentially abnormal steel determines the degree of abnormality. Transformation temperatures above 700°C are required to obtain significant quantities of abnormal structure. Partially transformed specimens show that the normal, inner pearlite is nucleated after the formation of the ferrite rim. The incubation period for the formation of the abnormal structure is much shorter than that associated with normal pearlite, as the abnormal transformation is initiated much earlier during isothermal transformation at a given temperature. (auth)

1266

Culcheth Labs., Research and Development Branch, Dept. of Atomic Energy (England)
FAST REACTOR—PHYSICAL PROPERTIES OF MATERIALS OF CONSTRUCTION. REVIEW OF PROGRESS FROM SEPTEMBER 1, 1953 TO APRIL 1, 1954. I. P. Bell and S. M. Makin. July 5, 1954. 17p. (RDB(C)/TN-70)

Determinations were made of the thermal conductivities of uranium and molybdenum. Thermal expansion measurements were made on uranium, titanium, nickel, tantalum, molybdenum, and uranium dioxide. (auth)

1267

Mallory, P. R., and Co., Inc.
THE MANUFACTURE OF TITANIUM ALLOYS. REPORT NO. 9—FINAL REPORT [FOR] AUGUST 3, 1950 TO DECEMBER 31, 1951. E. I. Larsen, L. S. Busch, R. H. Dickinson, and G. W. Bauer. 99p. Contract Noa(s)-51-006-C. (U-22916)

Ti-alloy ingots melted in He had higher tensile strengths and about the same ductility as those melted in A but had bluish rough surfaces. Foreign matter in the H_2O-cooling system of the power leads altered the heat balance of the furnace and appeared responsible for the porosity and metallic inclusions (unmelted sponge or alloy additions) of the ingots. Alloys were forged at 900 to 950°C and air-cooled; a 12- to 24-hr soak before forging made forging difficult but produced a more uniform microstructure, lower tensile strength, and better ductility. Induction-melted ingots of Ti powder had a markedly lower proportional limit than those of Ti sponge. A 0.95-in.-diam. 3% Al—5% Cr—Ti rod containing 0.5% C had temperature coefficients of resistance of 0.0036 and 0.0009 Ω/Ω/°C at 26 and 525°C, respectively; the alloy was more air-resistant and less N-resistant than unalloyed Ti at high temperatures. Arc-melted ingots had a lower tensile strength, proportional limit, and yield strength than induction-melted materials. Forged Al—Cr—Ti alloy was single-phased and had fine needles and grain boundaries and well-dispersed carbides. Forged and heat-treated Al—Cr—Ti microstructures were similar but contained large grain sizes. Quenching from 750° C produced heavy white grain boundaries with grains composed of fine needles. Al—Fe forging alloys of Ti had good tensile properties and high yield strengths and proportional limits but were quench-hardenable and were affected by the cooling rate after hot-forging Fe—V—Ti alloys were quench-hardenable and difficult to forge; Si additions increased the proportional limit/ultimate tensile strength ratio with little ductility loss. Annealed Ti sheets were slightly weaker but more ductile than forged Ti bars.

The induction-melted 3% Al–5% Cr–Ti alloy was difficult to cold-work in sheet form and had little ductility as annealed. Sheets from 4% ferroaluminum Ti ingots were the toughest of all Ti sheets. (auth)

1268

[Engineering Research Inst.], Univ. of Mich.
INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM-BASE ALLOYS. Jeremy V. Gluck and James W. Freeman. Sep. 1954. 113p. Contract AF33(616)-244. (WADC-TR-54-112)

The object of the investigation was to determine the relationship between typical structural conditions of representative titanium-base alloys and their mechanical properties in the range from 600 to 1000°F. In order to accomplish this purpose, tensile, short-time rupture, and creep properties were determined. The materials studied were: commercially pure titanium, Ti 75A; a commercial alpha-beta alloy, Ti 150A; an experimental stable alpha alloy, 6% Al–94% Ti; and an experimental stable beta alloy, 30% Mo–70% Ti. In addition, hardness, x-ray, and metallographic studies were made. The results indicate that the single-phase α or β alloys possess the best combination of properties at 1000°F. Commercially pure titanium, Ti 75A, exhibited lower properties than the alloys at all test temperatures. Wide ranges of strength variation through heat treatment were found for Ti 150A at 600 and 800°F; however, at 1000°F no essential difference between heat treatments was evident, and the absolute level of strength was quite low. The β alloy, 30% Mo, showed little or no response to prior treatment, but had the best combination of creep and rupture properties at 1000°F of the four materials tested. Both Ti 75A and the α alloy, 6% Al, showed improvement in strengths at 600°F from small amounts of cold working. At 1000°F an optimum amount of cold work, less than 10%, existed, above which properties were lowered through metallurgical instability. (auth)

1269

Columbia Univ. [School of Mines]
A FUNDAMENTAL STUDY IN THE PRINCIPLES GOVERNING SEIZING AND GALLING IN METALS. E. S. Machlin, W. R. Yankee, R. Duncan, and M. Gensamer. May 1954. 43p. Contract AF 18 18(600)-75. (WADC-TR-54-195)

An investigation of seizing and galling in metals was conducted by obtaining friction coefficients between a number of soft metal hemispheres in contact with harder metal flats. The metal surfaces were prepared by machining in argon followed by exposure to air. Variables included temperature and the hardness of the softer metal in the friction couple. Friction coefficients were measured between clean metal hemispheres and titanium flats containing oxygen and nitrogen in solid solution. Similarly, friction coefficients were measured between zinc hemispheres and copper–silicon alloy flats with varying silicon contents. As a basis for correlating surface adsorption calculations with friction coefficients, surface energies of liquid silver and silver alloys of 1 at. % lead and 1 at. % copper were measured. The seizure of metal pairs in a friction couple is related to solid phase weldability. This weldability is a function of the concentration of solute in the matrix. Oxygen and nitrogen in solution in titanium reduces the friction coefficient of the latter against other metals. Silicon in solution in copper reduces the friction coefficient of the latter against zinc. Lead in solution in silver reduces the friction coefficient against silver but raises it against lead. (auth)

1270

Dow Chemical Co.
[PRINCIPLES OF THE EFFECT OF RARE-EARTH ADDITIONS ON THE HIGH TEMPERATURE PROPERTIES OF MAGNESIUM]. INTERACTION OF PRECIPITATION, SOLID-SOLUTION CONTENT, AND CREEP IN MAGNESIUM–ALUMINUM ALLOYS. June 1954. 22p. Contract AF 33(038)-16655, [Supplemental Agreement No. S2 (52-286)]. (WADC-TR-54-295)

Microstructural studies of a Mg–10.3% Al alloy showed that discontinuous precipitation during aging multiplies the grain-boundary area available for easy deformation in elevated-temperature creep. An increase of strain rate for a 6.2% Al alloy at 400°F, where precipitation and creep are concurrent, caused an increase in the volume percent discontinuously precipitated at the completion of the process. Aluminum in solid solution was found to have little or no strengthening effect when deformation in creep is localized at the grain boundaries. The relatively poor elevated-temperature creep resistance of heat-treated alloys of the Mg–Al–Zn type may be explained in these structural terms. (auth)

1271

Carnegie Inst. of Tech.
INVESTIGATION OF GALLING AND FRICTION CHARACTERISTICS OF TITANIUM ALLOYS. FINAL REPORT. Eber W. Gaylord. Oct. 31, 1954. 74p. Contract DA-36-061-ORD-361. (WAL-401/65-37)

The normal loads and speeds that cause galling of unalloyed titanium rubbing on unalloyed titanium do not depend significantly on the apparent contact area of the rubbing specimens, but with larger areas galling damage appears to progress at a slower rate. When galling of a titanium slider block specimen rubbing on a steel plate occurs there is a significant increase in the amplitude of the fluctuations in normal load which may be detected by a piezoelectric crystal. Galling damage may increase in severity over a period of ten minutes or more. Heavy galling of metallic surfaces in dry rubbing is accompanied by a large increase in surface roughness and an increase in the coefficient of friction which becomes more or less independent of load. When there is no galling, the coefficient of friction is not reproducible and increases with time of rubbing. When there is no galling, a "dynamic thermocouple" formed by the junction of two dissimilar metals rubbing over each other may be used to get a fair estimate of the average interface temperature. A dynamic thermocouple will produce a randomly fluctuating component of voltage that increases to a much higher value when galling occurs. (auth)

1272

ON THE HYDROGEN SICKNESS OF SOME METALS. W. Bauklon and W. Stromburg. Translated by D. J. Wright from Z. Metallkunde 29, 427-33(1937). 29p. (TT-353)

It was established that the hydrogen sickness of copper is caused by reduction of the cuprous oxide inclusions and that the hydrogen has a particularly harmful effect when these inclusions migrate to the grain boundaries during annealing in a vacuum. The cracks follow an intercrystalline course, which is immediately apparent from the films made of the process. Investigations of the drawability of copper plates annealed in hydrogen showed the effect of temperature and of duration of annealing on the damage by hydrogen. No effect of electrolytic pickling on drawability or lattice enlargement could be observed. In conjunction with studies of copper, the phenomena of hydrogen sickness were also studied in relation to iron. (auth)

1273

NITRIDES OF TANTALUM. Georg Brauer and Karl Heinz Zapp (Chemisches Laboratorium der Universitat, Anorganische Abteilung, Freiburg i. Br., Germany). Z. anorg. u. allgem. Chem. 277, 129-39(1954) Nov. (In German)

During the synthesis of the element the entire Ta-N system was obtained in high purity. Investigation by chemical analysis and radiographic methods shows the existence of three phases: Ta nitride, Ta subnitrite, and the metal phase. The crystal structure of TaN was newly determined. It is hexagonal with the lattice constants being $a = 5.1808$ kX, $c = 2.9049$ kX, and axial ratio $c/a = 0.561$. The lattice cell contains three formula units. The Ta metal phase is able to absorb up to 4 at. % N with increase of the homogeneous lattice constant. (tr-auth)

1274

OXIDATION OF IRON-MOLYBDENUM AND NICKEL-MOLYBDENUM ALLOYS. S. S. Brenner (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 102, 7-15(1955) Jan.

Binary alloys of iron and molybdenum (up to 12.5 atomic % Mo) and nickel and molybdenum (up to 19.7 at. % Mo) do not exhibit "catastrophic oxidation" up to 1000°C either in stationary or in flowing atmospheres. In both systems, MoO_2 and iron molybdate or nickel molybdate are formed in addition to iron oxides or nickel oxide. Molybdenum significantly decreases the oxidation rate of iron by preventing formation of the cation-deficient FeO normally formed on iron above 570°C. The oxidation rate of nickel, however, is affected only to a small extent. Up to 3 at. % molybdenum the rate is slightly increased by the formation of additional vacancies in the nickel oxide, while beyond 12 at. % the oxidation rate is again decreased owing to the densification of the MoO_2 subscale. (auth)

1275

CATASTROPHIC OXIDATION OF SOME MOLYBDENUM-CONTAINING ALLOYS. S. S. Brenner (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 102, 16-21 (1955) Jan.

When nickel or chromium is added to binary iron-molybdenum alloys, catastrophic oxidation occurs in certain concentration regions. Chromium is more effective than nickel in inducing this rapid type of oxidation. Catastrophic oxidation occurs because of the formation of liquid MoO_3 along the metal-oxide interface. This is preceded by the cracking of the chromium or nickel-containing oxide. Catastrophic oxidation does not occur with alloys containing large amounts of nickel. (auth)

1276

DIFFUSION OF COBALT IN MOLYBDENUM. E. S. Byron and V. E. Lambert (Westinghouse Electric Corp., Bloomfield, N. J.). J. Electrochem. Soc. 102, 38-41(1955) Jan.

Diffusion coefficients for cobalt in molybdenum were determined at 900, 1100, 1275, 1500, and 1700°C. In the equation relating diffusion coefficient with temperature, $D = Ae^{-Q/RT}$, the activation energy Q derived was 34,800 cal/mole, and the constant A was 2.82×10^{-6} cm^2/sec. (auth)

1277

VISCOSITY OF THE SODIUM–POTASSIUM SYSTEM. C. T. Ewing, J. A. Grand, and R. R. Miller (Naval Research Lab., Washington, D. C.). J. Phys. Chem. 58, 1086-8(1954) Dec.

Viscosity coefficients in the low-temperature range from 60° (or the mp) to 200° for sodium, potassium, and several alloys have recently been published. A nickel viscometer of the Ostwald type has been used to substantiate these measurements and to extend results to 700°. For each metal and alloy, the extended coefficients also exhibited normal temperature variation which is adequately expressed by an equation set forth by Andrade. The coefficients at higher temperatures were intended for engineering application, and no attempt was made to duplicate the precision of the results measured in glass. A composite curve of isotherms representing both sets of measurements can be drawn from which the viscosity-temperature curve for any alloy in the sodium–potassium system can be derived. (auth)

1278

SELF-DIFFUSION IN COPPER. A. Kuper, H. Letaw, Jr., L. Slifkin, E. Sonder, and C. T. Tomizuka (Univ. of Illinois, Urbana). Phys. Rev. 96, 1224-5(1954) Dec. 1.

The self-diffusion coefficient of copper has been determined by tracer techniques through the use of a precision grinder and a precision lathe. The temperature dependence over the range 685 to 1062°C is given by $D = 0.468 \exp(-47\,140/RT)$ cm^2/sec. (auth)

1279

THE PRODUCTION OF WELDED STAINLESS STEEL PIPE. A Grodner (Continental Copper and Steel Industries, Inc., Perth Amboy, N. J.). Welding J. (N. Y.) 33, 1171-4(1954) Dec.

Procedures for production welding, radiographing welds, heat treatments, and inspection in the fabrication of stainless steel piping up to $^7/_{16}$ in. thick and 14 in. in diameter are presented. (auth)

1280

ETCHING OF STEEL BY IONIC BOMBARDMENT. I. N. Prilezhaeva, G. V. Spivak, and M. I. Malkina. Zhur. Tekh. Fiz. 24, 2090-6(1954) Nov. (In Russian)

1281

SYMPOSIA ON MATERIALS AND DESIGN FOR LIGHT-WEIGHT CONSTRUCTION. THE TITANIUM SEMINAR, 6 AUGUST 1952. Engineer Research and Development Labs, Ft. Belvoir, Va. MIMEO 95p. (PB-111083)

The reports presented at the Ti seminar are as follows: history of titanium, present production status of titanium, production, properties, and uses of high purity titanium, physical and mechanical properties of commercial titanium and its alloys, corrosion resistance of titanium and its alloys, shop characteristics of commercial titanium and its alloys, casting and forging of titanium and its alloys, and applications and potential uses for titanium and its alloys. (J.E.D.)

PHYSICS

1282

Digital Computer Lab., Mass. Inst. of Tech.
RUDIMENTS OF GOOD CIRCUIT DESIGN. TALK DE-

LIVERED AT THE ELECTRONIC COMPONENTS SYMPOSIUM, PASADENA, CALIFORNIA, APRIL 30, 1953. REPORT R-224. N. H. Taylor. May 19, 1953. 20p. Contract [AF19(122)-458]. (AD-18061)

Circuits which depend on the absolute stability and reproducibility of components have proved to be unreliable and often impractical for field use. A study of the tolerances of a circuit to its component variations, when made a part of the design procedure, will lead to better equipment, producible and usable in the field. Such a study often leads to new circuits and new ways of obtaining results. (auth)

1283

National Lead Co. of Ohio

THERMAL DIFFUSIVITIES AND CONDUCTIVITIES OF GREENSALT: GREENSALT-MAGNESIUM BLENDS, DOLOMITE, AND SLAG. K. O. Beatty, Jr. July 1, 1954. 20p. Contract AT(30-1)-1156. (FMPC-471)

The thermal diffusivities and conductivities of powdered uranium tetrafluoride, uranium tetrafluoride blended with magnesium, Norton fused dolomite, and recycle slag (largely MgF_2) have been measured over a temperature range of 100 to 600°F or somewhat higher. All of the measurements were made on the materials in powdered form with air or nitrogen as the interstitial gas. (auth)

1284

WAVE DISPERSION FROM A RANDOMLY UNEVEN SURFACE. M. A. Isakovich. Translated by E. R. Hope from Zhur. Ekspt'. i Teoret. Fiz. 23, 305-14(1952). 16p. (AEC-tr-1972)

A method is proposed for calculating the mean values of the intensity and of the fluctuation of waves scattered from a rough surface, with irregularities which are large as compared with the wavelength. The method is applicable both to the acoustic and to the electromagnetic case. (auth)

1285

ANISOTROPY OF DIFFUSION IN GRAIN BOUNDARIES. S. R. L. Couling and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh, Penna.). J. Appl. Phys. 25, 1538-42(1954) Dec.

Grain-boundary penetrations of radioactive silver into copper bicrystals having a common cubic direction have been measured using an autoradiographic technique. Diffusion occurred along directions forming an angle $\varphi = 0°, 45°$, and 90° with the common cubic direction. For very low angles of disorientation θ, no preferential intergranular penetration was observed; for low and intermediate relative orientations, grain-boundary diffusion was found to be most rapid along the common direction ($\varphi = 0°$); for high angles of misfit, little anisotropy of boundary diffusion was detected. The observed asymmetry about $\theta = 45°$ of the curves of grain boundary penetration vs. θ is in agreement with the known dependence of the density of boundary dislocations on the angle between grains and on grain boundary direction. The anisotropy measurements may be qualitatively explained in terms of the distribution and relative amounts of elongated areas of "fit" and "misfit" in the grain boundary, and they confirm with the earlier proposed model of grain boundaries in the region of angles where the simple dislocation model does not apply. (auth)

1286

MEASUREMENTS OF AGE BY THE CARBON-14 TECHNIQUE. Hl. De Vries and G. W. Barendsen (State Univ. of Groningen, Netherlands). Nature 174, 1138-41(1954) Dec. 18.

Age determinations were made by means of C^{14} using a proportional counter filled with CO_2 prepared from the sample. The work done on specific geological and archeological samples is summarized. (M.P.G.)

1287

ELECTRON CAPTURE. IV. CAPTURE FROM HELIUM ATOMS BY FAST PROTONS. B. H. Bransden, A. Dalgarno and N. M. King (Queen's Univ. of Belfast, England). Proc. Phys. Soc. (London) A67, 1075-85(1954) Dec.

A modified Born approximation is used to calculate the cross sections for capture of electrons from helium atoms by fast protons and for capture from hydrogen atoms by helium ions. A comparison is made with experimental data and it is shown that the Brinkman-Kramers approximation is inadequate. The theoretical results lend support to the data of Hasted and Stedeford and cast serious doubts on the accuracy of the data of experimentalists. (auth)

1288

X-RAY DIFFRACTION PATTERNS FROM LIQUID HELIUM. W. L. Gordon, C. H. Shaw, and J. G. Daunt (Ohio State Univ. Columbus, Ohio). Phys. Rev. 96, 1444-5(1954) Dec. 1.

Intensity as a function of scattering angle for copper $K\alpha$ x-rays has been determined for liquid helium (mass 4) at temperatures above and below its lambda point. Proportional counter registration of the scattered x-ray intensity was used together with a Ross differential x-ray filter and a differential pulse height analyzer for monochromatization and for spurious background reduction. Scattering angles from 1.5° to 90° were covered. The helium sample was contained in a one quarter inch diameter, thin-walled beryllium tube in good thermal contact with, but separate from, a temperature regulating helium bath. The sample temperature was determined from its vapor pressure. (auth)

1289

ELECTROPLATING TECHNIQUE FOR Tl^{204}. A. Van Cleve and F. D. McDonough (Signal Corps Engineering Lab., Fort Monmouth, N. J.). Nucleonics 12, No. 12, 53(1954) Dec.

A uniform high-activity β-ray source was obtained by electrodepositing Tl^{204} onto a copper disk. Metallic Tl was dissolved in nitric acid and precipitated as thallium sulfide. The precipitate was dissolved in perchloric acid to obtain the plating bath. Only a small amount of plating solution is necessary. There was a slight activity loss to the walls of the plating chamber. (M.P.G.)

1290

POWDER DENSITY MEASUREMENT BY GAS BURETTE. Atsuo Nishioka and Kyozo Sekikawa. J. Phys. Soc. Japan 9, 873-4(1954) Sept.-Oct.

A method is described for using a gas burette in place of a pycnometer for measuring the density of fine particles of a few microns in diameter. Results in the case of carbonyl iron powders are presented in tabular form. The over-all accuracy of density was found to be 1 to 2% in the case of specimens of about 1 to 2 cc. Consistent results are also reported in the case of pure metal blocks such as Al, Cu, and Zn but not in the case of a strong adsorptive fine powd such as carbon black. (C.H.)

1291

THE MEASUREMENT OF PARTICLE SIZE IN VERY FINE POWDERS. Horace Edgar Rose (Univ. of London, England New York, Chemical Publishing Co., Inc., 1954. 127p.

Recent developments in the field of particle size measurement are reviewed and results from research now in progress are discussed. An attempt is made by the author to systematize the existing knowledge on the subject, to analyze the factors upon which the choice of an apparatus or a technique for a particular purpose depends, and to elucidate the principles upon which the design of some of the more important pieces of apparatus is based. (C.H.)

COSMIC RADIATION

1292

PRIMARY ALPHA PARTICLES IN THE COSMIC RADIATION NEAR THE GEOMAGNETIC EQUATOR. Martin A. Pomerantz (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). J. Franklin Inst. 258, 443-59(1954) Dec. (cf. NSA 8-6771)

An apparatus consisting of a G-M counter coincidence train in which is interposed a high-pressure ionization chamber has been utilized to obtain measurements of the flux of primary helium nuclei during a series of balloon flights in India. The instrument records relativistic particles characterized by a specific ionization at least as great as that of an alpha particle. The experiments were conducted at geomagnetic latitudes of 18°N and 3°N. At each station, the intensity $N(I > 3.2I_{min})$ of particles producing ionization chamber pulses exceeding the bias setting corresponding to $3.2I_{min}$, plotted on a logarithmic scale as a function of atmospheric depth, follows a straight line. The intensity N_{total} was also measured by removing the criterion $I > 3.2I_{min}$. Taking into account local nuclear interactions initiated by protons, knockon electrons accompanying protons, and slow protons (albedo) which actuate the apparatus, the alpha-particle flux is determined from the extrapolated values of N_{total} and $N(I > 3.2I_{min})$ at the "top of the atmosphere." The results are 49 ± 13 particles m^{-2} sec^{-1} $sterad^{-1}$ at $\lambda = 3°$ N and 81 ± 22 particles m^{-2} sec^{-1} $sterad^{-1}$ at $\lambda = 18°$ N. The qualitative effect of the presumably small systematic uncertainties is generally in the direction of making these values low. The composition of the primary cosmic radiation is not drastically different at $\lambda = 3°$ and $\lambda = 18°$, although the total intensity is anomalously high at the latter station. (auth)

1293

ON THE ABSORPTION OF COSMIC RAYS UNDERGROUND. S. Higashi, M. Oda, T. Oshio, H. Shibata, and K. Watanabe (Osaka City Univ., Japan). J. Phys. Soc. Japan 9, 655-8 (1954) Sept.-Oct.

The local absorption in lead absorbers in a counter telescope has been measured at depths of 20, 25.5, and 40 m.w.e. and compared with the absorption produced by increasing the depth underground. It was found that the former agrees with the latter within the limit of the accuracy of the measurement. The results show that at least 98 percent of the cosmic rays underground consist of μ mesons coming from the atmosphere and that the remainder has short ranges and may be composed of electrons produced by μ mesons in the ground. The cosmic rays underground created by unknown processes are probably very few. (auth)

1294

ON THE UNSTABLE HEAVY MESON DECAYING IN FLIGHT IN THE PHOTOGRAPHIC EMULSION EXPOSED AT HIGH ALTITUDES. Kiyosi Niu (Nagoya Univ., Japan). J. Phys. Soc. Japan 9, 659-65(1954) Sep.-Oct.

On the decay event of the unstable heavy meson was found in the photographic plate exposed at high altitude. The unstable heavy meson was decayed in flight into single lighter charged meson and assumed to be k particle on account of the energy-momentum relation at the decay point. The possibility that this event occurred due to a spurious distortion such as wetting effect will not be completely neglected, because the direction of motion of the emitted particle is very close to that of the parent. It seems quite difficult to interpret the whole event by the wetting effect. (auth)

1295

HODOSCOPE STUDY OF COSMIC RADIATION. M. Biasutti, R. Favre, Ch. Haenny, and A. Heym. Helv. Phys. Acta 27, 484-5(1954) Nov. (In French)

1296

INTERACTION OF HEAVY PRIMARY COSMIC RAYS IN LEAD. Y. Eisenberg (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 96, 1378-82(1954) Dec. 1.

The energy spectrum of heavy primary cosmic-ray nuclei was measured and found to be in agreement with the assumption that no primaries with energy below the geomagnetic cutoff enter the earth. The mean free path of the primary nuclei in lead was measured. If the transparency of nuclear matter is taken into account, the present results for lead and the measurements by others for lighter elements are in good agreement. If the expression $R_A = R_0 \times A^{1/3}$ is used for the radius of the nucleus, the data indicate for R_0 the value 1.3×10^{-13} cm. It is also shown that the ratio of the abundances of the charge groups Z = 12 to 17 and Z = 18 to 28 is ~2.1. (auth)

1297

COMPOSITION OF THE PRIMARY COSMIC RADIATION AT $\lambda = 10°$ N. G. W. McClure (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 96, 1391-1400(1954) Dec. 1.

A balloon-borne instrument comprising a fast ionization chamber interposed in a G-M counter train has been flown near the geomagnetic equator for the purpose of determining the fluxes of protons and He nuclei in the primary cosmic radiation. The apparatus measures the specific ionization of each particle that traverses the telescope, and contains a shower detector to aid in the identification of multiple-particle events of either local or external origin. Under the assumption that all telescope coincidences resulted from particles incident within the counter-defined solid angle, the total vertical flux, extrapolated to the "top of the atmosphere," is $I_{total} = 260$ $sterad^{-1}$ m^{-2} sec^{-1}. The "top"-extrapolated fluxes of primary protons and He nuclei deduced from the ionization distributions recorded at various depths (17 g/cm^2 and greater) are as follows: $I_H < 145$ $sterad^{-1}$ m^{-2} sec^{-1}; $I_{He} < 38$ $sterad^{-1}$ m^{-2} sec^{-1}. The large difference between I_{total} and $(I_H + I_{He})_{max}$ is believed to arise from air showers and/or nuclear events produced by particles incident from outside the telescope solid angle. The consequences of neglecting these spurious effects in interpretating counter-telescope measurements are discussed with particular reference to influences on the deduced form of the primary-proton energy spectrum, and the total energy flux associated with the primary radiation. (auth)

1298

PRODUCTION SPECTRA OF COSMIC-RAY MESONS IN THE ATMOSPHERE. Stanislaw Olbert (Massachusetts Inst. of

Tech., Cambridge). Phys. Rev. 96, 1400-7(1954) Dec. 1.

Recent experimental data on the differential vertical intensities of μ mesons in the atmosphere make it possible not only to improve the original Sands' production spectrum of μ mesons but also to study its dependence on the geomagnetic latitude. It is shown that, for the residual ranges, R′, between 100 g cm^{-2} and 6000 g cm^{-2}, the production spectrum may be approximated by an empirical formula of the type: $C(a + R')^{-\gamma}$ where C and γ are numerical constants practically independent of the geomagnetic latitude. The latitude dependence of the production spectrum is thus expressed through the parameter a which displays a monotonic decrease with increasing latitude. With numerical values of a, C, and γ, compatible with experimental data, the production spectrum of μ mesons is then used as a basis for the derivation of the differential and integral energy spectra of charged π mesons. The latitude dependence of the π-meson spectrum is linked to the geomagnetic cut-off of the primary cosmic radiation, which leads to some crude conclusions on the average multiplicity of π mesons produced in proton collisions with air nuclei. In particular, the dependence of the multiplicity on the primary energies between 2 and 13 bev is studied in detail and compared with Fermi's statistical theory of π-meson production. (auth)

1299

ABUNDANCE OF LITHIUM, BERYLLIUM, AND BORON IN THE PRIMARY COSMIC RADIATION. M. F. Kaplon, J. H. Noon, and G. W. Racette (Univ. of Rochester, N. Y.). Phys. Rev. 96, 1408-16(1954) Dec. 1.

The flux of nuclei of charge greater than two of the primary cosmic radiation has been measured at 41 and 55° geomagnetic latitudes with photographic emulsions flown in "Sky Hook" balloons. The technique used at the lower latitude is similar in principle to that employed originally by Bradt and Peters, while that used at the higher latitude is the method of Dainton, Fowler, and Kent. The different experimental methods are discussed and the latter is found more satisfactory for the light-element problem. Primary flux values are reported for the medium nuclei ($6 \leq Z \leq 10$) and the heavy nuclei ($Z > 10$) at the two latitudes. It is concluded that there exists a finite primary flux of the light nuclei ($3 \leq Z \leq 5$) and the most reliable value from these experiments of the ratio of the primary light-nuclei flux N_L^0 to the primary medium-nuclei flux N_M^0 at the top of the atmosphere is found to be 0.46 ± 0.15. (auth)

1300

TRIPLETS OF COSMIC RADIATION: PRODUCTION CROSS SECTION. Madeleine Avan and Louis Avan. Compt. rend. 239, 1372-4(1954) Nov. 22. (In French)

The production cross section of cosmic-ray triplets by high-energy electron pairs was determined. After elimination of pseudo-triplets, the value $\sigma = (14 \pm 4) \times 10^{-24}$ cm^2 was obtained. (tr-auth)

1301

THE TIME COHERENCE OF ASSOCIATED COSMIC RAY PARTICLES. V. C. Officer and P. J. Eccles (Univ. of Melbourne, Australia). Proc. Phys. Soc. (London) A67, 1037-50(1954) Dec.

Short reaction time Geiger counters have been used at sea level to study the time coherence of associated cosmic ray particles under 18 cm of Pb, and also in air. A 50-channel hodoscope has been used to identify the events giving coincidences between two 138 cm^2 trays of these counters separated by 15 cm in a horizontal plane. No evidence was found for delays between associated particles of the order of 2×10^{-8} sec, as reported by Robinson using spark counters, although the counter resolving time of 1.4×10^{-8} sec should have allowed detection of the effect. Multiple hits by particles on the Geiger counter trays were found to give modified counter reaction time distributions, and it is suggested that a similar effect could occur in spark counters. A theory which accounts for the behavior of both spark and Geiger counters under multiple hit conditions has been developed. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1302

Ames Lab.
PREPARATION OF MICROSCOPIC CRYSTALS FOR ELECTRICAL MEASUREMENTS. W. C. Shaw, D. E. Hudson, and G. C. Danielson. [Feb. 21, 1954]. 13p. Contract [W-7405-eng-82]. (ISC-464)

Techniques for cleaning, sorting, and mounting microscopic single crystals have been developed. Five spring-loaded probes have been placed on specimens less than 0.3 mm in their largest dimension. Crystals 0.15 mm in length have been provided with four electrodes. It is believed that the method described could be successfully extended to specimens considerably less than 0.1 mm long. These techniques make it possible to measure the electrical properties of microscopic crystals. (auth)

1303

ZEEMAN SPLITTING OF NUCLEAR QUADRUPOLE RESONANCE LINE OF BROMINE. Shoji Kojima, Kineo Tsukada, Akira Shimauchi, and Yasushi Hinaga (Tokyo Univ. of Education, Japan). J. Phys. Soc. Japan 9, 795-801(1954) Sept.-Oct.

With a single crystal of about 35 g, which was prepared by the method of the pointed-bottom crucible, Zeeman patterns of the pure quadrupole spectrum of bromine were studied. The observations were carried out in the following orientations of the magnetic fields: (1) parallel to the b axis of the crystal, (2) parallel to the c axis, and (3) about 43° from the b axis in the a plane. The pattern at the b axis, where the magnetic field was perpendicular to all molecular bonds, consisted of four lines. This indicated the existence of asymmetry in the field gradient tensor. The asymmetry parameter η was determined as 20 percent. This large value was discussed from the standpoint of resonance switching of auxiliary bonds. (auth)

ELECTRICAL DISCHARGE

1304

Research Lab. of Electronics, Mass. Inst. of Tech.
BASIC DATA OF ELECTRICAL DISCHARGES. TECHNICAL REPORT NO. 283. Sanborn C. Brown and W. P. Allis. June 2, 1954. 83p. Contract [DA36-039-sc-100]. (NP-5448)

Data in the form of tables and graphs are presented on excitation and ionization potentials of atoms, collision probabilities, surface phenomena such as secondary emission, motions of electrons and ions, production and decay of ionization, voltage breakdown, electron energy loss, and discharge characteristics. Formulas and definitions are also included. (M.P.G.)

ELECTRONS

1305

A METHOD OF MEASURING THE SPEED OF HIGH-ENERGY ELECTRONS. Moréno Papoular. Compt. rend. 239, 1194-6(1954) Nov. 8. (In French)

A method is proposed for measuring the speed of high-energy electrons by applying relativistic corrections to an electron beam passing through a specially designed wave guide. The resonant frequency, which can be accurately measured, is shown to be related to the accelerating voltage of the electron beam, and therefore to its speed. (K.S.)

1306

EMISSION OF ENERGETIC SECONDARY ELECTRONS PRODUCED BY 1.3-MEV ELECTRON BOMBARDMENT. R. A. Shatas, J. F. Marshall, and M. A. Pomerantz (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 96, 1199-1203(1954) Dec. 1.

The emission of energetic secondary electrons (delta rays or knock-on electrons) produced by 1.3-Mev primaries which penetrate thin targets with negligible mean energy loss has been investigated. These have previously not been observable in the customary thick-target experiments because of the inherent impossibility of distinguishing between true secondaries and reflected primaries which have suffered large energy losses. The present arrangement does not record back-scattered primaries, but only emitted electrons. The delta ray yields from various targets (Al, Ni, Au, Ag, Cu, C) ranging in thickness from 5×10^{-6} to 10^{-2} in. have been measured. The determinations of I_δ/I_P vary between 0.3 and 2.1 percent, independent of surface treatment, and there is only a small dependence of the yield upon target material for an equivalent thickness expressed in mg/cm^2. For 45.8 mg/cm^2 Ni, the delta ray yield is 2.08 ± 0.15 percent. This may be compared with 1.48 ± 0.25 percent, the yield of low-energy secondaries as measured with the cleanest surface attainable in the demountable experimental tube. (auth)

1307

THICK TARGET BREMSSTRAHLUNG SPECTRA FOR 1.00-, 1.25-, AND 1.40-MEV ELECTRONS. William Miller, J. W. Motz, and Carmen Cialella (National Bureau of Standards, Washington, D. C.). Phys. Rev. 96, 1344-50(1954) Dec. 1.

The spectrum of radiation produced by 1.0-, 1.25-, 1.40-Mev electrons incident on a thick tungsten target was measured at 0° and 90° with the incident beam by a method involving the magnetic analysis of Compton electrons. The effects of electron scattering and energy loss in the target preclude any simple interpretation of this data to yield a differential bremsstrahlung cross section. However, an estimate of the spectra to be expected at 0° and 90° was obtained by combining the Sauter expression for the bremsstrahlung cross section with the available information on electron scatter and energy loss in the target and backscatter from the target. The reliability of the estimate is limited because the Sauter formula was calculated by using the Born approximation, the electron scattering calculations are applicable to an infinite medium only, and the backscatter was estimated empirically from Bothe's experimental data which were obtained with lower energy electrons (370 kev). Furthermore electron energy straggling was neglected. Nevertheless, the predicted spectral shapes at 0° and 90° and the relative intensities in these two angles are in qualitative agreement with the measured values. The absolute magnitudes of the measured intensities at both angles are about a factor of two greater than the predicted values. (auth)

INSTRUMENTS

1308

Knolls Atomic Power Lab.

A LOG AND PERIOD AMPLIFIER FOR REACTOR CONTROL. R. S. Stone and E. J. Wade. Oct. 12, 1954. 25p. Contract W-31-109-Eng-52. (KAPL-1236)

The most recent developments in logarithmic amplifiers and period amplifiers at the Knolls Atomic Power Laboratory are described. The theory of operation and circuit design are discussed. The operational characteristics of the amplifiers are greatly improved over those of earlier models by the use of feedback circuits and compensating circuits. (auth)

1309

THE "NORELCO" X-RAY DIFFRACTOMETER. W. Parrish, E. A. Hamacher, and K. Lowitzsch (Philips Labs., Irvington-on-Hudson, N. Y.). Philips Tech. Rev. 16, 123-33 (1954) Oct.

A new version of the "Norelco" x-ray diffractometer, a completely re-designed version of the geiger counter x-ray spectrometer, is described. The new version incorporates an improved resolution of diffraction lines ($CuKa_1$-a_2 separation visible at $2\Theta > 30°$), better accuracy in the measurement of diffraction angles (readings to 0.01° in 2Θ) and of relative line intensities, and a higher diffraction angle range (up to $2\Theta = 165°$). These improvements are due to the use of a new x-ray optical system together with a normal basic diffraction unit having a high-powered water-cooled x-ray tube with mica-beryllium windows, and to the design of a high-precision mechanical geiger counter goniometer. The new x-ray optics is based on the use of a line-focus source. Owing to this feature and to a vertical arrangement of the x-ray tube and goniometer circle, it is possible to use two goniometers and two normal photographic powder-diffraction cameras simultaneously with the four window x-ray tube of one basic diffraction unit. Scanning speeds varying from $\frac{1}{8}$ to 2° per minute can be selected; alternatively an automatic stepwise movement of the goniometer is possible. Apart from automatic recording, either continuously or point-by-point, the electronic circuits developed for the instrument permit the application of special counting methods. (auth)

1310

DESCRIPTION OF A SPECTRAL ANALYZER FOR THE STUDY OF THE SCINTILLATION EFFECT. C. Manus, J. P. Borel, and R. Mercier (Laboratoire de Physique, E.P.U.L., Lausanne, Switzerland). Helv. Phys. Acta 27, 497-502 (1954) Nov. (In French)

An apparatus is described for analyzing the background noise arising from scintillation effects in various materials and thin foils. (K.S.)

ISOTOPES

1311

AMERICAN STANDARDS FOR RADIOISOTOPES. Atomics 5, 340-2; 348(1954) Dec.

The research necessary to produce standards for radioactive nuclides is carried out by the National Bureau of Standards, who have been engaged in his work for the United States Government since 1926. An extensive programme of research is in operation in order to meet the new requirements of industry and research laboratories. Meanwhile, the Bureau is also collaborating with United Kingdom and Canadian Government research bodies with a view to comparing radioactive standards and creating international standards of radium and artifically produced radioisotopes. (auth)

ISOTOPE SEPARATION

1312

Oak Ridge National Lab., Y-12 Area
ELECTROMAGNETIC CONCENTRATION OF THE STABLE ISOTOPES OF ZINC. L. O. Love, W. A. Bell, and H. J. Buttram. Nov. 9, 1950. Decl. Oct. 5, 1954. 17p. Contract W-7405-eng-26. (Y-693)

Zinc was processed with beta M-12 ion source units in the 24-in. radius calutron using Zn metal as the charge material and was collected in Cu pockets provided with water cooling coils. Zinc receiver specifications for the calutron are given. The process was evaluated on the basis of the samples of enriched material produced. Distribution of samples enriched in Zn isotopes with masses of 64, 66, 67, 68, and 70 is shown. (J.A.G.)

1313

ENRICHMENT OF Rb^{85} BY COUNTERCURRENT ELECTROMIGRATION. Ernest R. Ramirez (Univ. of Zurich, Switzerland). J. Am. Chem. Soc. 76, 6237-9(1954) Dec. 20.

A diaphragm countercurrent electromigration apparatus has been used to enrich Rb^{85}. The cell packing consisted of closely spaced diaphragms whose planes lie perpendicular to the flow of the countercurrent liquid. The enrichment took place in an aqueous medium with RbOH as the electrolyte. The voltage source employed in the experiment was 2300v. The highest separation factor attained was 1.085. The Rb^{85} concentration was raised from 72.2 to 73.8% in 200 hr. (auth)

MASS SPECTROGRAPHY

1314

A PEAK HEIGHT COMPARISON METHOD FOR MASS SPECTROMETRY. C. Taylor (A.B. Atomenergi, Stockholm, Sweden). Arkiv Fysik 8, No. 3, 201-10(1954).

A circuit is described which scans alternately the tops of two mass peaks whose amplitude is to be compared and couples in a precision potential divider when the larger of the two peaks is being scanned. The divider is adjusted by hand so that the peaks, which are displayed on a potentiometric recorder, are brought to the same height, and their amplitude ratio is then read off directly from the setting of the divider. By backing off the recorder, the gain may be increased while still keeping the peaks on scale, and in this way a change in ratio of 1% may be expanded to 20 mm or more on the paper of the recorder. The device can be used for mass pairs which may be widely separated and may lie anywhere in the range of the spectrometer. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1315

Brookhaven National Lab.
FLOOR INSPECTOR. Jere C. Austin. [nd]. (BNL-1874)

A commercial portable survey meter equipped with an end-window geiger tube was mounted with window down, 0.25 in. from the floor, in the center of a pig. The pig is 7 in. in diameter and provides 2.75 in. of shielding around the circumference of the tube. The instrument proved satisfactory for scanning floor areas for gross contamination. The wooden mounting block was angled to afford a view of the meter, though in actual use the headphones proved more useful. (C.H.)

1316

Consolidated Vultee Aircraft Corp.
BF_3 THERMAL NEUTRON DETECTION CHANNEL. C. F. Johnson. July 23, 1954. 45p. (CVAC-263T; MR-N-47)

1317

Knolls Atomic Power Lab.
A GENERAL PURPOSE LOG COUNTING RATE METER—MODEL B. R. S. Stone and E. J. Wade. Nov. 1, 1954. 19p. Contract W-31-109-eng-52. (KAPL-1237)

This report is a brief description of a general purpose logarithmic counting rate meter developed at the Knolls Atomic Power Laboratory. The theory of operation and the circuit design are discussed. The use of a diode as a logarithmic element in the integrating circuit allows extremely accurate counting rate determinations over a five decade range. (auth)

1318

Naval Ordnance Lab.
A WIDE BAND FILM DOSIMETER. Norman Modine. Sept. 20, 1954. 19p. (NAVORD-3803)

This report contains the results of engineering tests on a device for measuring radiation exposure. The method is based on the use of photoelectric emission from lead screens to obtain an energy-discriminating film dosimeter with the net effect of determining an energy-independent dose value, as well as an effective quantum energy value for simple x- or gamma-ray spectra. (auth)

1319

SIGNAL, NOISE AND RESOLUTION IN NUCLEAR COUNTER AMPLIFIERS. A. B. Gillespie (Atomic Energy Research Establishment, Harwell, Berks, England). London, Pergamon Press, Ltd., 1953. 155p.

1320

PRODUCTION OF PLASTIC PHOSPHORS IN QUANTITY. L. Wouters (Univ. of California, Berkeley). Nucleonics 12, No. 3, 26-7(1954) Mar.

A procedure for the polymerization of plastic scintillators is described. The monomer is heated to the reaction temperature with terphenyl for an activator and terphenyl butadiene for a wavelength shifter, and the polymerization is allowed to proceed exothermally. Delay time of the styrene plastic phosphors is 5 mμsec. (M.P.G.)

1321

SCINTILLATION DETECTOR FOR CARBORNE AND AIRBORNE USE. F. J. Davis, J. A. Harter, P. W. Reinhardt, and C. F. Harris (Oak Ridge National Lab., Tenn.). Nucleonics 12, No. 12, 46-7(1954) Dec.

A scintillation detector has been developed specifically for geologists and prospectors, taking into consideration the needs and operating conditions that one encounters while operating radiation detection equipment in the field. The equipment weighs 31 lb, not including the recorder and scintillation head, and is operated from either the 6-volt or 12-volt storage battery of any car or light aircraft. Rapid calibration and standardization are possible at any time during field operations by such features as built-in standardization of amplifier gain and high voltage and counting-rate meter calibration. (auth)

1322

GAIN VARIATION OF PHOTOMULTIPLIER TUBES. R. L. Caldwell and S. E. Turner (Magnolia Petroleum Company, Dallas, Texas). Nucleonics 12, No. 12, 47-8(1954) Dec.

It has been found that the gain of certain photomultiplier tubes increases during exposure to γ rays and gradually decreases after exposure. Five Dumont 6292 tubes were checked, and changes in gain were observed in all of them. No change was observed in either of the two RCA 5819 tubes tested. No permanent change was observed in any of the tubes. (M.P.G.)

1323

ECONOMICAL SCINTILLATION SCANNER. Theodore E. Sopp, Samuel V. Geyer, and J. Stauffer Lehman (Hahnemann Medical Coll. and Hospital, Philadelphia, Penna.). Nucleonics 12, No. 12, 49(1954) Dec.

A low-cost instrument for mechanically scanning radioactive-material concentrations in vivo has been constructed and is described. A scintillation detector is used with a scanning speed of 20 in. per min. Recording is accomplished by a pointed rod activated by pulse from the detector which taps layers of paper and carbon paper. (M.P.G.)

1324

AUTOMATIC ISODOSE PLOTTER. G. A. Mauchel and H. E. Johns (Univ. of Saskatchewan and Cancer Clinic, Saskatoon, Canada). Nucleonics 12, No. 12, 50-1(1954) Dec.

An automatic device is described which plots isodose curves to indicate dosage distribution in a water phantom irradiated with x or γ rays. The plotter consists of two independent ionization chambers, two identical d-c amplifiers, a ratio circuit, and a servo system. Ten isodose curves may be measured and plotted in about 10 min. Random fluctuations of output from the x-ray machine are balanced out. (M.P.G.)

1325

AUTOMATIC SAMPLER, RECORDER. A. D. Hosey, H. H. Jones, O. C. Marsh, and R. G. Gallaghar (Department of Health, Education, and Welfare, Cincinnati, Ohio). Nucleonics 12, No. 12, 52-3(1954) Dec.

A portable instrument is described for automatically collecting airborne contaminants. Twenty-four samples can be collected for sampling periods of 15 min. to 6 hr. Radioactivity is determined immediately after collection by means of a G-M tube, counting-rate meter, and recording milliammeter. The instrument weighs 100 lbs. The estimated cost of components is $1,500. (M.P.G.)

1326

BETAMETRIC AND GAMMAMETRIC APPARATUS ADAPTED TO THE STUDY OF RADIOACTIVE DEPOSITS COLLECTED IN FLIGHT. Hubert Garrigue. Compt. rend. 239, 1207-8(1954) Nov. 8. (In French)

An ionization chamber is described for application to the measurement of atmospheric radioactivity such as that resulting from atomic bomb explosions. The design was evolved from basic requirements necessitating the sampling of large air volumes and the need for portability. The capacity of the chamber is 3 liters, the window is large ($120\ cm^2$) and thin ($2.7\ mg/cm^2$), and the counter is suitable for measuring β and γ radiation. (K.S.)

1327

STUDY OF THE GRADIENT OF A MAGNETIC FIELD OF A SOLENOID WITH THE AID OF NUCLEAR RESONANCE. Louis Dick, Roger Foucher, Nils Perrin, Hamlet Vartapetian, Georges Béné, Pierre Denis, and Richard Extermann. Compt. rend. 239, 1376-8(1954) Nov. 22. (In French)

A technique was developed for measuring the magnetic field within the magnet of a β-ray spectrometer by observation of nuclear resonance effects in liquids. The method permits field measurements to a degree of accuracy which is superior to that of conventional ballistic galvanometer or flux-meter techniques. (K.S.)

1328

A POCKET DOSEMETER, WITH BUILT-IN CHARGER, FOR X-RADIATION AND GAMMA RADIATION. N. Warmoltz and P. P. M. Schampers. Philips Tech. Rev. 16, 134-9(1954) Oct.

Following a brief recapitulation of the effects of ionizing radiations upon biological tissue, the principles of dosimetry, tolerance dosages, and the effects of intense irradiation are considered. After descriptions of existing types of pocket dosimeter a more detailed account is given of a new design which incorporates a self-charger and which dispenses with a microscope. This instrument is fully enclosed in a vacuum-tight bulb of conductive glass which, in turn, is housed in an aluminum case. Full scale deflections corresponding to dosages of 0.2, 70, 250 r, or more, can be obtained by adopting suitable dimensions for the instrument and by varying the gas pressure. The discharge in the absence of radiation is considerably less than 1%/24 hr. The charger is a glass tube containing a drop of mercury, which during the charging process, is connected to the sensitive system by means of a magnetic switch. Charging is effected by shaking the instrument several times, with the electrometer system facing downwards. Attention also is drawn to the suitability of the individual electroscope and charger systems for demonstration purposes. (auth)

1329

THE RELIABILITY OF NUCLEONIC INSTRUMENTS. Denis Taylor (Atomic Energy Research Establishment, Harwell, Berks, England). J. Brit. Inst. Radio Engrs. 14, 570-80 (1954) Nov.

The paper discusses the servicing of nucleonic instruments under factory conditions and considers some of the problems which have arisen in the British Atomic Energy Project. The annual failure rates of some of the standard instruments are given, and attention is called to the component failures. It is noted that much progress has been made in improving the reliability and life of some of the newer components, e.g., G-M counters, and that the failure rates are highest for the more orthodox components, e.g., thermionic valves and resistors. Experiences are quoted from British, American, and Canadian sources. Reviewing the analyses presented, an attempt is made to lay down a number of guiding principles to follow when designing complete instruments. (auth)

1330

ON THE EXTERNAL CATHODE PROPORTIONAL COUNTER. Isao Kumabe and Masateru Sonoda (University of Kyoto, Japan). J. Phys. Soc. Japan 9, 877-8(1954) Sept.-Oct.

Design details of an external cathode proportional counter are described, and operating characteristics are evaluated. (C.H.)

1331

PLATE SEPARATION REQUIREMENTS FOR STANDARD

FREE-AIR IONIZATION CHAMBERS. Frank H. Attix and LeRoy DeLaVergne. Radiology 63, 853-66(1954) Dec.

The lack of agreement between the free-air ionization chambers used at several national laboratories as standards for the measurement in r of x-radiation doses below 200 kv is discussed. Results of previous measurements made with free-air chambers are reviewed and data are presented from studies of the plate-separation requirements for x rays generated by potentials up to 259 kv. (C.H.)

1332

A CLOUD CHAMBER STUDY OF SOME ASPECTS OF THE GEIGER DISCHARGE. P. J. Campion (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A67, 1095-1102(1954) Dec.

An expansion-type cloud chamber controlled by an internal counter has been used to study the discharge formed in the latter when operated in the Geiger and transitional regions. Both ethyl and iso-amyl alcohols have been used at their saturation vapor pressures as the combined condensant and quenching agent, together with argon or helium at various total pressures below one atmosphere. Significant differences in the behavior of the counter are observed for the two alcohols, which can be attributed to the difference in the proportion of quenching agents in the two cases. The photographic evidence shown supports the accepted theory of Geiger counter operation. (auth)

1333

A CdS RADIATION PROBE OF HIGH RESOLUTION. C. H. Bachman, O. J. Gelormini, and H. W. Davis (Syracuse Univ., N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 98-102(1955) Jan.

Design and operating characteristics are described of a CdS crystal radiation probe of high resolution and sufficiently small to allow detailed measurements of the intensity distribution of a convergent beam tube of extremely small size. (C.H.)

1334

FUNDAMENTAL PROBLEMS IN APPLICATION OF RADIOACTIVE RADIATIONS TO MEASUREMENT TECHNIQUES. N. I. Shteĭnbok. Uspekhi Fiz. Nauk 54, 231-84(1954) Oct. (In Russian)

A review and discussion. 81 references. (G.Y.)

MESONS

1335

INTERACTION OF A NEGATIVE HEAVY MESON. J. E. Naugle, E. P. Ney, P. S. Freier, and W. B. Cheston (Univ. of Minnesota, Minneapolis). Phys. Rev. 96, 1383-5(1954) Dec. 1.

An interaction caused by a stopping heavy meson has been observed in emulsion. One of the four particles emitted in the interaction is interpreted as a nuclear fragment with a Λ^0 attached. The subsequent mesonic decay of this bound Λ^0 leads to a Q of 34.2 ± 0.9 Mev. The measured mass of the heavy meson is $1010 \pm 200 m_e$. The visible kinetic energy released in the interaction it causes is 50 ± 8 Mev. (auth)

1336

SEARCH FOR THE PRODUCTION OF μ-MESON PAIRS BY A 345-MEV SYNCHROTRON BEAM. B. T. Feld, A. Julian, A. C. Odian, L. S. Osborne, and A. Wattenberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 1386-90 (1954) Dec. 1.

Observations made at 45° and 90° to a 345-Mev bremsstrahlung beam failed to indicate the production of pairs of μ^+-μ^- mesons from targets of Be and Al. From the run on Be at 45°, $\sigma(\mu \text{ pair}) < (4 \times 10^{-32}/16\pi^2)$ cm^2 (steradian)$^{-2}$ proton^{-1}. This upper limit is twenty times the value predicted by the Bethe-Heitler theory for a purely electromagnetic interaction. The result would seem to preclude any interaction between pairs of μ mesons and nucleons which is as large as 10^{-3} of the strength of the interactions of π mesons and nucleons. (auth)

1337

MEASUREMENT OF COULOMB INTERFERENCE IN 113-MEV π^+-p SCATTERING. Jay Orear (Univ. of Chicago, Ill.). Phys. Rev. 96, 1417-20(1954) Dec. 1.

Pion-proton scatterings with a small angle cutoff of 12.5° in the center-of-mass system were detected using the area-scanning, nuclear-emulsion technique. Ilford G5 plates 600 microns thick were exposed to a flux of 4.4×10^5 mesons/cm^2 in the 122-Mev π^+ beam of the Chicago cyclotron. Various checks indicated a scanning efficiency greater than 90 percent for scatterings on the hydrogen content of the emulsion between 12.5° and 160°. Out of a total 420 hydrogen events only two scatterings were less than 20°. The data when analyzed according to the two possible sets of signs of the phase shifts give a strong preference for destructive interference, i.e., attractive $p_{3/2}$ interaction. In this case the maximum likelihood solution is $\alpha_3 = -(10.9 \pm 2)^\circ$, $\alpha_{33} = (27.0 \pm 1.5)^\circ$, and $\alpha_{31} = -(3.2 \pm 1)^\circ$ for the s- and p-wave phase shifts with no definite indication of a d-wave component. The total nuclear cross section is (79 ± 5) millibarns. The mean energy of pions in the emulsions is (113.0 ± 1.6) Mev as determined from 33 events where the proton stops in the emulsion. (auth)

1338

PRODUCTION OF MESONS BY PERIPHERAL COLLISION OF NUCLEONS. V. T. Khozyainov. Zhur. Ekspt'l. i Teoret. Fiz. 27, 445-57(1954) Oct. (In Russian)

MOLECULAR PROPERTIES

1339

RAMAN EFFECT AND INTERMOLECULAR INTERACTIONS. (Raman-effkt i Mezhdumolekuliarnoe Yzaimodeistvie). M. V. Vol'kenshtein. Translated by G. Belkov from Uspekhi Fiz. Nauk 18, 153-202(1937). 60p. (TT-499)

1340

CONTRIBUTION OF OVERLAP INTEGRAL TO NUCLEAR QUADRUPOLE COUPLING. Kineo Tsukada (Tokyo Univ. of Education, Japan). J. Phys. Soc. Japan 9, 872-3(1954) Sept.-Oct.

The contribution of overlap integral to nuclear quadrupole coupling was estimated for the molecules Cl_2, Br_2, and I_2. Data calculated by using both the resonance switching model and the macromolecule model are presented. (C.H.)

NUCLEAR PHYSICS

1341

EXPERIMENTAL NUCLEAR PHYSICS. VOLUME I. E. Segre, Ed., H. Staub, H. Bethe, J. Ashkin, N. F. Ramsey, and K. T. Bainbridge. New York, John Wiley and Sons, Inc., 1953. 789p.

This volume is the first of a set of three, and contains separate chapters devoted to particle detection, passage of radiations through matter, nuclear moments and statistics, two-body problems and nuclear structure, and charged particle dynamics, optics, isotope abundances, and atomic masses. (K.S.)

1342

THE ABSOLUTE STANDARDIZATION OF THE 2.615 MEV γ-RAYS OF ThC'' AND THE CROSS SECTION FOR THE PHOTO DISINTEGRATION OF THE DEUTERON AT THIS ENERGY. P. Marin, G. R. Bishop, and H. Halban (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A67, 1113(1954) Dec. (cf. NSA 7-5209)

While intercomparing their Ra standard (N.P.L. certificate C 2521) against the Paris substandard, the authors discovered that an error had been made in interpretation of the intensity of their standard (Marin, Bishop, and Halban, Proc. Phys. Soc. (London) A66, 608(1953)). The correct value was incorporated in the previous results, yielding the following values: 1.15 ± 0.01 mc as the milligram Ra equivalent of Pb^{212}; 0.407 ± 0.007 mc as the milligram Ra equivalent of Tl^{208}; $(13.0 \pm 0.29) \times 10^{-28}$ cm^2 as the cross section for photodisintegration of the deuteron. (L.T.W.)

1343

MULTIPLE PHOTON PRODUCTION IN ELECTRON-POSITRON ANNIHILATION. Suraj N. Gupta (Purdue Univ., Lafayette, Ind.). Phys. Rev. 96, 1453(1954) Dec. 1.

An investigation of the multiple production of photons at high energies, due to the annihilation of an electron-positron pair, shows that despite the smallness of the fine structure constant, multiple processes in quantum electrodynamics are not negligible at high energies. It is shown that such considerations lead to an explanation of the unusual multiple photon shower recently reported by Schein. (K.S.)

1344

COHERENT MESON PROCESSES. Walter Thirring (Univ. of Bern, Switzerland). Helv. Phys. Acta 27, 515-18(1954) Nov. (In English)

Several consequences of the recently observed elastic production of π^0 mesons by photons on D_2 and He are discussed in connection with the theory of meson forces. (K.S.)

1345

PRODUCTION AND ANNIHILATION OF NEGATIVE PROTONS. III. James McConnell (St. Patrick's Coll., Maynooth, Ireland). Proc. Roy. Irish Acad. 56, Sect. A, 45-65 (1954) July.

Previous calculations on the production of negative protons by meson-nucleon collisions are extended to the case of inelastic proton-neutron collisions. Pseudoscalar mesons with pseudovector coupling are considered together with vector mesons. A comparison of the results with other investigations is made, using perturbation methods and radiation damping theory. According to the present theory, pair production probability at high energies is very small, a result which differs from Fermi's theory. (K.S.)

1346

ENERGY SPECTRUM OF NEUTRONS EMITTED BY POLONIUM SOURCES. Marie Ader. Compt. rend. 239, 1290-1 (1954) Nov. 15. (In French)

The emission of neutrons by Po sources has previously been attributed to the presence of impurities, notably Be, in the source material. The neutron spectrum of a Po source was examined by an observation of proton tracks produced by the interaction of the source neutrons with a nuclear emulsion. Comparing the spectrum with that obtained from a Po-Be source shows that the emission of neutrons by a Po source cannot be attributed to the presence of the Be impurity. (K.S.)

NUCLEAR PROPERTIES

1347

THE LEVEL SCHEME OF In^{115}. J. Varma and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). J. Franklin Inst. 258, 516(1954) Dec.

The disintegration of the 2.3-day Cd^{115} and its isomer, the 43-day Cd^{115}, has been studied with thallium-activated sodium iodide counters, anthracene counters, and coincidence methods. The levels of In^{115} have been shown to have excitation energies of 0.335 ($T_{1/2}$ = 4.5 hr), 0.595, 0.825, 0.858 0.935, 1.30, and 1.42 Mev, the first four levels being excited in the decay of the 2.3-day period alone and the latter three in decay of the 43-day activity only. The γ transitions from the 1.3-Mev level proceed directly to the ground state of In^{115} while all the transitions from the 1.42-Mev level terminate at the 0.935-Mev level. The γ transitions from the 0.595, 0.825, and 0.858-Mev levels lead to the metastable state at 0.335 Mev. About 3% of the transitions from the 0.858-Mev level terminate at the 0.825-Mev level which in turn de-excites by way of a 0.230 Mev-0.260 Mev γ ray cascade or by emission of a 0.490-Mev quantum in the cross-over transition. The angular correlation function for the 0.485-Mev –0.935 Mev cascade in the decay of the 43-day Cd^{115} is found to be essentially isotropic. A level scheme for In^{115} has been established by these measurements. (entire paper)

1348

THE MEASUREMENT OF NUCLEAR QUADRUPOLE MOMENTS OF THE FIRST EXCITED STATE OF Cd^{111} WITH THE AID OF γ-γ ANGULAR CORRELATION. H. Albers-Schönberg, E. Heer, T. B. Novey, and P. Scherrer (Physikalisches Institut der Eidg. Technischen Hochschule, Zurich, Switzerland). Helv. Phys. Acta 27, 547-71(1954) Nov. (In German)

A method for the determination of nuclear quadrupole moments of shortlived excited states is described. The method consists of a measurement of angular correlation of two successive gamma rays, using a single crystal with axial symmetry as a radioactive source. If, in addition, a magnetic field is applied, the magnetic dipole as well as the electric quadrupole moment may be obtained in one experiment. The method has been applied to the cascade of Cd^{111}. The activity was embedded in a metallic In single crystal. The measured quadrupole coupling was $eQq/h = 13.8 \pm 0.15$ mc/sec, from which the quadrupole moment of the 247-kev level has been estimated to be $Q \sim 10^{-24}$ cm^2. The magnetic moment of the same state was measured with an improved arrangement. The value obtained was $\mu = -(0.725 \pm 0.047)\mu_k$. (auth)

1349

FLUORINE-PLUS-PROTON REACTION. R. W. Peterson, W. A. Fowler, and C. C. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. 96, 1250-8(1954) Dec. 1.

The properties of certain energy levels in O^{16}, F^{19}, and Ne^{20} have been studied by observations on the alpha particles and inelastic protons from the bombardment of fluorine by protons. A high-resolution magnetic analysis of the alpha-particle groups to the 2^+ and 1^- levels in O^{16} from the $F^{19}(p,\alpha)O^{16*}$ reaction failed to reveal any doublet structure in these known levels. The angular distributions of the alpha-particle groups to these levels did not indicate degeneracy with a 2^- level, nor did a search for new excited levels in O^{16} up to 8.7-Mev excitation reveal a 2^- level. These results are not in agreement with the alpha-particle model of the O^{16} nucleus which predicts a 2^- state close in energy to the 2^+ state. Angular distributions of the alpha particles were measured at proton bombarding energies of 873, 935, 1290, 1355, and 1381 kev. The distributions at 1355 kev indicated that the corresponding Ne^{20} resonance level at 14.16 Mev has spin 2 and odd parity. The spin and parity assignments previously found for the other levels were confirmed. A study of the inelastic proton groups from the $Fe^{19}(p,p')F^{19*}$ reaction gave 108.8 ± 0.8 and 196.0 ± 1.4 kev for the excitation energies of the two lowest excited levels of F^{19}. The cross sections at the 1431-kev resonance for these groups in the center-of-mass system were 0.187 ± 0.015 barn for the first group and 0.007 ± 0.002 barn for the second group. At 1381 kev the cross section was 0.0427 ± 0.0040 barn for protons to the second excited level. Angular distributions of the proton groups were measured and, in conjunction with other studies made in this laboratory, resulted in spin and parity assignments of $\frac{1}{2}^-$ and $\frac{5}{2}^+$ for the first and second excited states of F^{19}, respectively. (auth)

1350

EXCITATION CURVE FOR $C^{14}(d,p)C^{15}$ AND PROPERTIES OF C^{15}. James A. Rickard, Emmett L. Hudspeth, and William W. Clendenin (Univ. of Texas, Austin). Phys. Rev. 96, 1272-5(1954) Dec. 1.

The excitation function for $C^{14}(d,p)C^{15}$ has been studied with deuterons of energy 0.6 to 3.0 Mev. A previously suspected resonance was definitely established at a bombarding energy of 2.15 Mev, with a width of nearly 400 kev. Analysis of the excitation curve shows that its shape may be explained on the basis of a spin of $\frac{5}{2}(+)$ for the C^{15} ground state and a Q value of 0.15 ± 0.15 Mev. This leads to a mass of C^{15} of 15.0141 ± 0.00015 amu. (auth)

1351

NUCLEAR RESONANCE OF Nb^{93} IN $KNbO_3$. R. M. Cotts and W. D. Knight (Univ. of California, Berkeley). Phys. Rev. 96, 1285-93(1954) Dec. 1.

The nuclear resonance of Nb^{93} in a single crystal of $KNbO_3$ has been studied in magnetic fields of approximately 5000, 100, and zero oersteds, and at temperatures between −196°C and +460°C. The quadrupole splitting of the magnetic resonance line in strong fields is found to be a sensitive function of crystal structure and, hence, of temperature. Temperatures of the phase transitions found in this way at about −50, +220, and +430°C are in agreement with other known data for this substance. The splitting $\Delta\nu$ of one satellite line is a continuous function of temperature between 220 and 430°C; near 430°C $\Delta\nu$ changes abruptly, indicating a first-order phase change. Below the Curie temperature (430°C) $KNbO_3$ is ferroelectric, with noncubic crystal structure. Above 430° it is cubic and a single resonance line is observed. Four lines have been identified in the pure quadrupole spectrum in zero magnetic field, and at 20°C. From the four frequencies the quadrupole coupling constant and asymmetry parameter are evaluated to be 23.1 Mc/sec and 0.80, respectively. At −196°C, the frequencies are different from the room temperature values, and the quadrupole coupling is evaluated to be 16.0 Mc/sec and the asymmetry parameter 0.0, the latter appropriate to the rhombohedral crystal structure at this temperature. The Zeeman effect in magnetic fields up to about 100 oersteds is shown to be an aid in identifying the absorption lines and in locating the principal axes of the crystalline electric field gradient. The value of the quadrupole coupling constant is consistent with the existence of a strong covalent character in the chemical bonding to the Nb. (auth)

1352

UPPER LIMIT ON THE NEUTRINO MAGNETIC MOMENT. C. L. Cowan, Jr., F. Reines, and F. B. Harrison (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 96, 1294 (1954) Dec. 1.

A liquid scintillation detector and neutrinos from a fisson reactor were employed to set a new upper limit of 10^{-7} Bohr magnetons for the neutrino magnetic moment. (auth)

1353

ENERGY LEVELS OF Be^{10*}. J. J. Jung and C. K. Bockelman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 1353-5(1954) Dec. 1.

A magnetic spectrograph has been employed to measure the momenta of proton groups emitted at 90 degrees from a thin beryllium target bombarded by deuterons. Groups were observed corresponding to the ground state of Be^{10}, as well as known levels at 3.37, 5.96, 6.26, 7.35, and 7.54 Mev. A new level at 6.18 Mev was also seen. (auth)

1354

SPIN, MAGNETIC MOMENT, AND HYPERFINE STRUCTURE OF Rb^{81}. J. P. Hobson, J. C. Hubbs, W. A. Nierenberg, and H. B. Silsbee (Univ. of California, Berkeley). Phys. Rev. 96, 1450(1954) Dec. 1.

The spin, hyperfine splitting, and nuclear moment of Rb^{81} (4.7 hr) have been measured. They are $\frac{3}{2}$, 5000 ± 125 Mc/sec, and 2.00 ± 0.06 nuclear magnetons respectively. The zero-moment method of atomic beams was used. (auth)

1355

E3 ISOMER IN Ir^{191}. J. W. Mihelich, M. McKeown, and M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96, 1450-2(1954) Dec. 1.

The 129-kev photopeak of Ir^{191} from pile-irradiated Ir isotopes was measured. The decaying half life was 6.8 ± 1.0 sec, a value subsequently redetermined as 5.6 ± 0.4 sec by other workers. The measured half life is attributed to the 42-kev transition or some other unobserved transition. A plot of L ratios in odd-A isotopes of Au support the conclusion that the Ir^{191} 42-kev transition is E3. The decay scheme and energy levels are discussed. (K.S.)

1356

5.6-SECOND Ir^{191m} FOLLOWING Os^{191} DECAY. R. A. Naumann and J. B. Gerhart (Princeton Univ., New Jersey). Phys. Rev. 96, 1452-3(1954) Dec. 1.

NUCLEAR REACTORS

1357

HETEROGENEOUS POWER REACTORS. W. H. Zinn (Argonne National Lab., Lemont, Ill.). Nucleonics 12, No. 12, 54-6(1954) Dec.

Advantages of heterogeneous reactors for power are considered. Pressurized-water reactors, boiling-water reactors, and Na-cooled reactors are described and compared. (M.P.G.)

NUCLEAR TRANSFORMATION

1358

AN INVESTIGATION OF THE (γ,n) REACTION IN Cu, Zn, AND Ag. D. St. P. Bunbury. Proc. Phys. Soc. (London) A67, 1106-7(1954) Dec.

An attempt was made to find whether a fine structure could be observed in the (γ,n) excitation functions of heavier elements, namely, Cu, Zn, and Ag. The results indicate that fine structure is present. (L.T.W.)

1359

LEVELS OF ^{24}Mg FROM THE ^{27}Al(p,α)^{24}Mg REACTION. G. W. Greenless (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A67, 1107-8(1954) Dec.

A study of the reaction of Al^{27}(p,α)Mg^{24} showed three α groups of lengths 10, 23, and 31μ. The three groups give Q values of 1.61 ± 0.04, 0.23 ± 0.03, and −2.57 ± 0.04 Mev, corresponding to levels in Mg^{24} at 0, 1.38, and 4.18 Mev. The differential cross sections were estimated as 0.16 b/sterad (1.16 Mev), 0.61 b/sterad (0.23 Mev), and 0.15 b/sterad (−2.57 Mev). (L.T.W.)

1360

A POSSIBILITY OF CHECKING THE NUCLEAR SHELL MODEL. L. A. Sliv and L. K. Peker. Zhur. Ekspt'. i Teoret. Fiz. 25, No. 3, 381-3(1953). (In Russian)

The existence of 3 groups of excited nuclei resulting from a slow-neutron capture can be explained by differences in the nature of γ emission if one knows the spins of the target nucleus and product neucleus in the ground state and their parity. The nuclear shell model makes it possible to obtain the data required for the analysis of the γ transitions. The available experimental data on the nature of γ transitions in (n,γ) reactions are tabulated. Out of ~30 examples given, only N^{14} is at variance with the authors' explanation. (Science Abstracts)

1361

THE REACTION ENERGY OF O^{17}(d,α)N^{15}. Rolf Pauli, Katarina Ahnlund, and Curt Mileikowsky. Arkiv Fysik 8, No. 3, 213-17(1954).

Thin targets of O^{17} were prepared and used to measure the ground-state transition O^{17}(d,α)N^{15} which has not been reported previously. Q values and α spectra of the reaction are reported. (L.T.W.)

1362

COULOMB EXCITATION OF F^{19} BY ALPHA PARTICLES. R. Sherr, C. W. Li, and R. F. Christy (California Inst. of Tech., Pasadena). Phys. Rev. 96, 1258-66(1954) Dec. 1.

Gamma rays emitted in the excitation of F^{19} by α particles of 0.6 to 2.8 Mev have been studied. Resonances are found in the reaction F^{19}(α,p)Ne^{22*} at α particle energies greater than 1.3 Mev and in the inelastic excitation of 109-kev and 196-kev levels in F^{19} at energies greater than 2.2 Mev. At bombarding energies below 2 Mev, the cross sections for inelastic excitation of F^{19} decrease much too slowly for compound nucleus formation and are identified as being due to Coulomb excitation. The observed cross sections in the region 0.6 Mev to 2 Mev agree well with the theory for Coulomb excitation. The electromagnetic transition probabilities for decay of these states deduced from the excitation cross sections are in good agreement with those found from direct measurement of the lifetimes by Thirion, Barnes, and Lauritsen. Together with the results of Peterson, Barnes, Fowler, and Lauritsen on the inelastic excitation of fluorine by protons, these experiments lead to spin and parity assignment of $\frac{1}{2}^-$ for the 109-kev state and $\frac{5}{2}^+$ for the 196-kev state of F^{19}. The observed angular distributions of the γ rays from Coulomb excitation by α particles are also in accord with theory. (auth)

1363

PHOTODISINTEGRATION OF HELIUM. Everett G. Fuller (National Bureau of Standards, Washington, D. C.). Phys. Rev. 96, 1306-9(1954) Dec. 1.

Helium gas at atmospheric pressure was irradiated with 26-, 29-, 32-, and 40-Mev bremsstrahlung spectra. The energy and angular distributions of the protons produced by the photodisintegration of He^4 were studied using nuclear emulsions to detect the charged particles. Angular distributions of the protons are fitted to a differential cross section of the form $\sigma(\theta_{c.m.}) \sim (a/b) + \sin^2\theta_{c.m.}[1 + (\gamma/b)\cos\theta_{c.m.}]$. Over the energy range studied, the interference term may increase slowly with energy but is approximately constant (γ/b = 0.2 ± 0.1); the istropic term increases rapidly with energy from 0 to 0.33 ± 0.2 at a mean photon energy of 32.5 Mev. The (γ,p) cross section reaches a peak value of about 1.8 mb at about 26 Mev. $\int_{26}^{40}\sigma dE = 0.016 \pm 0.006$ Mev barns. (auth)

1364

CHARGED PARTICLES FROM THE BOMBARDMENT OF Li^7 BY He^3. C. D. Moak, W. M. Good, and W. E. Kunz (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1363-5(1954) Dec. 1.

A (Li^7)$_2$SO$_4$ target was bombarded with He^{3++} ions at 720 kev, and the energies of the charged particles emitted were analyzed by means of a NaI spectrometer. The spectrum was found to consist in part of particles smoothly distributed in energy; and in part of relatively sharp groups of particles of defined energies. Evidence is presented that the five highest pulse height groups of charged particles consist of protons corresponding to defined energy states in Be^9. The observed proton energies are 10.51 ± 0.03, 8.9 ± 0.2, 8.3 ± 0.2, 7.6 ± 0.1, and 6.1 ± 0.10 Mev. In addition, group of particles were barely discernible at the lower half of the pulse height scale used for the protons. Although these groups of particles are not positively identified, it seems relatively certain that they are α-particles corresponding to Li^6 in its various energy states. A special attempt to identify groups of deuterons failed, indicating that for some reason the formation of Be^8 is discriminated against in this reaction. (auth)

1365

FINE STRUCTURE IN THE VELOCITY DISTRIBUTIONS OF SLOWED FISSION FRAGMENTS. R. B. Leachman and H. W. Schmitt (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 96, 1366-71(1954) Dec. 1.

Fine structure is observed in the velocity distributions of U^{235} fission fragments that have been slowed by aluminum or nickel, but none is observed for unslowed fragments. Identification of this velocity fine structure with the fine structure in the fission mass yield confirms the influence of the 82-neutron shell in the fission act, as distinguished from its influence in post-fission neutron boil-off. The production of velocity fine structure by aluminum or nickel slowing is shown, by means of the measured range-velocity relation of fragments in these metals, to be the result of isobaric velocity bunching. The measured range-velocity relation of fragments in gold indicates no velocity bunching and therefore is consistent with the absence of velocity fine structure in measured velocity distributions of U^{235} fragments slowed in gold or platinum. The absence of velocity fine structure in the velocity distribution of U^{233} and Pu^{239} fragments slowed by aluminum is discussed. (auth)

PARTICLE ACCELERATORS

1366

Brookhaven National Lab.
EXTERNAL PROTON BEAM OF THE COSMOTRON. O. Piccioni, D. Clark, R. Cool, G. Friedlander, and D. Kassner. [Nov. 3, 1954.] 8p. (BNL-2075)

A method is described for the ejection of the accelerated proton beam from the Brookhaven synchrotron. (C.H.)

1367

[European Council for Nuclear Research]
MESURES SUR LE MODELE AC III ALIMENTE EN COURANT ALTERNATIF 50 Hz. (Measurements of Model AC III [Magnet] Supplied with 50 Cycle Alternating Current). Oct. 1954. 10p. (CERN-PS/MM-7)

The behavior of the Model AC III model magnet for the CERN synchrotron is studied when excited by 50-cycle alternating current. In particular, the effect of eddy currents in the vacuum chamber walls on the magnetic field and its gradient is considered. An analysis of magnet characteristics by this technique was not found to be as satisfactory as dynamic measurements. (K.S.)

1368

High Voltage Research Lab., Mass. Inst. of Tech.
FEASIBILITY OF COMPACT 4 MEV ELECTROSTATIC X-RAY SOURCE. STUDIES OF COMPRESSED GAS AND HIGH VACUUM INSULATION. SUPPLEMENTARY FINAL REPORT FOR THE PERIOD JUNE 1952 THROUGH JUNE 1954. Dec. 1, 1954. 47p. (Includes a reprint: RADIOGRAPHIC PROPERTIES OF X-RAYS IN THE 2 TO 6 MEV RANGE. C. H. Goldie, K. A. Wright, J. H. Anson, R. W. Cloud, and J. G. Trump). ASTM Bull., p.49-54(1954)Oct. Contract DA-19-020-ORD-2023. (NP-5447)

The feasibility and performance characteristics are described of four-million-volt Van de Graaff electrostatic accelerator designed for the continuous and pulsed radiography of heavy metal sections, and applicable to other scientific and medical purposes. Engineering and scientific studies on the properties of compressed gas and vacuum for the insulation of high constant voltages and other factors influencing the design of such a compact supervoltage radiographic unit are summarized. (C.H.)

1369

ELECTRON LINEAR ACCELERATORS FOR RADIATION PROCESSING. Davis R. Dewey, II, John C. Nygard, and Maurice G. Kelliher (High Voltage Engineering Corporation, Cambridge, Massachusetts). Nucleonics 12, No. 12, 40-1 (1954) Dec.

The penetration of 1 to 3 Mev electrons is not sufficient for the radiation processing of many products. For higher energy electrons a traveling-wave electron accelerator appears to be more promising than direct linear accelerators. Electron energies up to 10 Mev can be obtained without the unwieldy insulation requirements of the direct accelerator. (M.P.G.)

1370

EXPERIMENTAL STUDIES OF BETATRON ORBIT STABILITY. G. C. Baldwin, F. R. Elder, and W. F. Westendorp (General Electric Company, Schenectady, N. Y.). J. Appl. Phys. 25, 1553-5(1954) Dec.

In the design of a betatron or synchrotron, an important parameter is the guide field exponent defined by $n = -\tau/B \frac{\partial B}{\partial \tau} = -\partial(\log B)/\partial(\log \tau)$, where τ is the radial position coordinate and B the flux density of the magnetic guide field. In this paper experiments are reported which have been made to study the behavior of electrons guided by fields of various n values. (L.T.W.)

1371

ON THE ORBITS IN THE STRONG-FOCUSING COSMOTRON BY A NON-LINEAR APPROXIMATION. Augustin Blaquière. Compt. rend. 239, 1285-7(1954) Nov. 15. (In French)

A method for approximating a solution of the Hill equation is developed, based on research for a series or Fourier integral solution. The result is extended to a non-linear equation with periodic coefficients which arises in the theory of the strong-focusing cosmotron. (tr-auth)

1372

EXPERIMENTAL STUDY OF A HELICAL WAVE GUIDE FOR A HEAVY PARTICLE LINEAR ACCELERATOR: PHASE VELOCITY. Albert Septier. Compt. rend. 239, 1367-9(1954) Nov. 22. (In French)

The electrical properties and phase velocity of a helical wave guide were experimentally investigated within a resonant cavity, with emphasis on the design and placement of the dielectric supports. Experiments were made with a bare helix, a shielded helix without support, and a helix supported with 3 plexiglass spacers. (K.S.)

1373

EXPERIMENTAL STUDY OF A HELICAL GUIDE FOR A PROTON LINEAR ACCELERATOR: SHUNT IMPEDANCE. Albert Septier. Compt. rend. 239, 1476-8(1954) Nov. 29. (In French)

The effect of dielectric supports on the value of the overvoltage coefficient and shunt impedance of a helical wave guide is studied, and the results are compared with theoretical predictions. (tr-auth)

1374

FIRST RESULTS OBTAINED WITH THE 1 MEV PARTICLE ACCELERATOR INSTALLED AT LYON. Jean Thibaud, Pierre Verzaux, and Raymond Salin. Compt. rend. 239, 1483-5(1954) Nov. 29. (In French)

RADIATION ABSORPTION AND SCATTERING

1375

Consolidated Vultee Aircraft Corp.
GROUND SCATTERED DOSE RATE CALCULATIONS USING A MONTE CARLO ALBEDO. R. D. Shelton, J. F. Perkins, and Earl Feinauer. Sept. 10, 1954. 21p. (CVAC-266T; MR-N-54)

An approximate analytic expression for the multiple scattering predicted by the Monte Carlo albedo calculations for Co^{60} has been obtained in a form readily applicable to ground scattering calculations for various source-detector geometries. It is seen that this expression, which contains the assumption that the ground scattering can be described as a surface effect, does not agree with the albedo assumptions usually made for the purpose of calculating ground scattered dose. The expression for the multiply scattered dose, when added to the known expression for the single scattered dose, should permit a calculation of the total ground scattered dose which is more accurate than calculations assuming single scattering only or single scattering plus the usual albedo assumptions. (auth)

1376

RADIATION ON COLLISION OF FAST NEUTRONS WITH PROTONS. I. Pomeranchuk and I. Shmushkevich. Translated from Doklady Akad. Nauk S.S.S.R. 64, 499-502(1949). 4p. (BNL-L-62(p.159-62); AEC-tr-794)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 4-313.

1377

ENERGY LOSS BY POSITIVE IONS BY SINGLE SCATTERING IN GASES AT SMALL ANGLES. N. V. Fedorenko. Zhur. Tekh. Fiz. 24, 1942-9(1954) Nov. (In Russian)

An experimental determination, by a mass spectrometric method, of the energy loss of 5- to 20-kev A^+ and I^+ ions and of A^+ ions undergoing electron stripping ($A^+ \rightarrow A^{++}$) single scattered in He, Ne, A, Kr, and N_2 at angles between 0 and 6° is reported. (G.Y.)

1378

COMPOSITION OF SLOW IONS FORMED IN GASES BY A PASSING BEAM OF POSITIVE IONS. N. V. Fedorenko. Zhur. Tekh. Fiz. 24, 1950-6(1954) Nov. (In Russian)

A mass spectrometric study of the species of ions formed in gases by single collisions of positive ions accelerated to 10 to 20 kv is reported. Data are presented on the species formed by A^+ ions in A, Kr, and N_2; N_2^+ ions in N_2; and A^{++} ions in A, Ne, and Kr. (G.Y.)

1379

ELASTIC SCATTERING OF ALPHA-PO PARTICLES ON HYDROGEN. Mira K. Jurić. Atomics 5, 333-9(1954) Dec.

A critical study is given of the possibility of working with natural radioactive sources by means of photo-nuclear plates in order to determine the angular distribution and measure the energy of particles. To achieve this, targets containing hydrogen were irradiated in vacuum by α-Po rays and the angular distribution of recoil-protons was observed. (auth)

1380

INELASTIC COLLISIONS BETWEEN HEAVY PARTICLES. III. EXCITATION OF HELIUM ATOMS IN FAST ENCOUNTERS WITH HYDROGEN ATOMS, PROTONS, AND POSITIVE HELIUM IONS. B. L. Moiseiwitsch and A. L. Stewart (Queen's Univ. of Belfast, England). Proc. Phys. Soc. (London) A67, 1069-74(1954) Dec.

Born's approximation is used to calculate the cross sections for the processes $H(1s) + He(1s^2) \rightarrow H(2s, 2p, 3s, 3p, 3d \text{ or } C) + He\ (1s2p\ ^1P)$, where C represents the continuum. It is found that these double transition collisions are collectively much more effective at high impact energies than the simple single transition collision $H\ (1s) + He(1s^2) \rightarrow H(1s) + He\ (1s2p\ ^1P)$ which is also investigated. Born's approximation is further used to calculate the cross sections for the processes $He^+\ (1s)\ (\text{or } H^+) + He(1s^2) \rightarrow He^+(1s)\ (\text{or } H^+) + He(1s2p\ ^1P)$ double transitions being here found to be unimportant. (auth)

1381

THE ELASTIC SCATTERING OF ELECTRONS BY THE EXCITED 2s AND 2p STATES OF ATOMIC HYDROGEN. P. Swan (Univ. Coll., London, England). Proc. Phys. Soc. (London) A67, 1086-94(1954) Dec.

The elastic scattering of electrons by H2s and H2p has been evaluated in the electron energy range 3 to 100 ev, the approximate method of Langer being used for large scattering phase-shifts and Born's approximation for the small phases corresponding to large values of the orbital angular momentum l. The total elastic cross sections for H2s and H2p are much larger than for the ground state H1s even at the lowest energy considered, the interpretation being that the long tails of the H2s and H2p potentials make the partial cross sections for waves of higher orbital angular momentum l very important compared with the partial S cross section. The effect of electron exchange is small even at 3 electron volts energy, an increase in cross section of 8% resulting from its inclusion, so that its effect has been neglected at higher energies. (auth)

1382

ON SOURCE SCATTERING IN ANGULAR CORRELATION EXPERIMENTS WITH SOFT ELECTRONS. E. Breitenberger (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A67, 1108-10(1954) Dec.

A safe upper limit to the expected scattering effects was derived, and a counting method which eliminates their insidious angular dependence was devised. (L.T.W.)

1383

THE ELASTIC SCATTERING OF 125 MEV ELECTRONS BY BERYLLIUM. K. M. Gatha, N. J. Patel, and P. F. Patel (M. G. Science Inst., Navarangpura, Ahmedabad, India). Proc. Phys. Soc. (London) A67, 1111-12(1954) Dec.

1384

SCATTERING OF NEUTRONS IN NITROGEN N^{14}. David Speiser. Helv. Phys. Acta 27, 427-40(1954) Oct. (In German)

The angular distribution of scattered neutrons from N^{14} is considered. Several methods of attacking the problem (N^{14} has spin 1) were discussed. The most extensive research was that of Blatt and Biedenharn for nuclei of higher spin based upon a generalization of the Breit-Wigner formula. (tr-auth)

1385

THE ABSORPTION OF π MESONS BY HEAVY NUCLEI. K. Bleuler and Ch. Terreaux (Univ. of Zurich, Switzerland). Helv. Phys. Acta 27, 489-91(1954) Nov. (In German)

1386

ANALYSIS OF PHASE SCATTERING FOR ELASTIC n-C^{12} SCATTERING BETWEEN 1.9 AND 3.8 MEV. P. Huber and R. Budde. Helv. Phys. Acta 27, 512-14(1954) Nov. (In German)

1387

DIFFUSION PARAMETERS OF THERMAL NEUTRONS IN WATER. G. von Dardel and N. G. Sjöstrand (AB Atomenergi, Stockholm, Sweden). Phys. Rev. 96, 1245-9(1954) Dec. 1.

A method is described for the determination of neutron diffusion parameters by measurements of the decay of thermal neutrons in a finite moderator with a pulsed-neutron source and a time analyzer. In the theory for the method one takes into account the "diffusion cooling" effect, which decreases the temperature of thermal neutrons below the temperature of the moderator. Measurements are reported on a cylindrical geometry, involving between 1 and 4 liters of distilled water. Analysis of the result yields a value of 0.333 ± 0.003 barns for the neutron-proton capture cross section, in good agreement with other measurements, and $(36\ 340 \pm 750)[1 - (0.20 \pm 0.04)k_0^2]$ cm^2/sec for the diffusion constant of thermal neutrons in water. The term involving the "buckling" k_0^2 of the geometry is due to the diffusion cooling effect. The value of the diffusion constant for $k_0^2 = 0$ leads to a value for the diffusion length in excellent agreement with the result of other measurements. The diffusion cooling effect is larger by a factor of 3.5 than the theoretical value, calculated for the model of a monatomic gas. (auth)

1388

ELASTIC SCATTERING OF 9.7-MEV PROTONS BY He^4.

Bruce Cork and Walter Hartsough (Univ. of California, Berkeley). Phys. Rev. 96, 1267-8(1954) Dec. 1.

The differential cross section for the scattering of 9.7-Mev protons from helium has been measured over the range from 17° to 154° in the center-of-mass system. The new 9.9-Mev proton linear accelerator, which is now used as an injector for the Bevatron, was used as a source of incident protons. A scattering chamber has been used that has the solid angles at the various scattering angles determined by fixed slits. The scattered particles were detected with sodium iodide scintillators and RCA 6199 photomultiplier tubes. The detectors were conveniently arranged so that each scintillator could be well shielded, and background runs could be made easily. The counters were arranged so that they could be interchanged and three angles have been measured simultaneously, with a statistical accuracy in the forward direction of better than ±1 percent. The differential cross-section measurements of the forward angles are in good agreement with published data in this energy region. However, the cross section for protons scattered in the backward direction is approximately 75 percent of the published value. (auth)

1389

SCATTERING OF 9.5-MEV PROTONS BY NITROGEN. R. G. Freemantle (Univ. of Birmingham, England), D. J. Prowse (Univ. of Bristol, England), and J. Rotblat (Univ. of London, England). Phys. Rev. 96, 1268-9(1954) Dec. 1.

The elastic and inelastic scattering of 9.5-Mev protons by N^{14} nuclei has been studied by means of photographic emulsions. Groups of inelastically scattered protons have been observed due to the excited states of N^{14} at 2.3, 3.9, 4.9, and 5.1 Mev; the first of these was excited in a very low intensity. Angular distributions have been determined for the elastic group of protons as well as for the inelastic group corresponding to the 3.9-Mev state; the latter curve is symmetrical about 90°. (auth)

1390

SCATTERING OF 9.5-MEV PROTONS BY NEON AND ARGON. R. G. Freemantle (Univ. of Birmingham, England), D. J. Prowse, A. Hossain (Univ. of Bristol, England), and J. Rotblat (Univ. of London, England). Phys. Rev. 96, 1270-1(1954) Dec. 1.

The photographic emulsion technique was employed to study the scattering of 9.5-Mev protons by neon and argon. Energy levels of Ne^{20} at 1.58, 4.20, 4.95, and 5.62 Mev have been observed as well as of A^{40} at 1.48 Mev. Angular distributions have been determined for the protons elastically scattered by Ne^{20} and A^{40}, as well as for the inelastic groups from the 1.58-Mev level of Ne^{20} and the 1.48-Mev level of A^{40}. (auth)

1391

SLOW NEUTRON CROSS SECTIONS OF GOLD, SILVER, INDIUM, NICKEL, AND NICKEL OXIDE. R. G. Allen, T. E. Stephenson, C. P. Stanford, and Seymour Bernstein (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1297-1305 (1954) Dec. 1.

The total reflection and selective attenuation properties of mirrors for neutrons were used to obtain essentially higher order free reflections of a beam of reactor neutrons from a quartz crystal. An arrangement of mirror, crystal, and sample, in series was used to measure the total cross section of Au, Ag, In, Ni, and NiO as a function of neutron wave length over intervals in the region between 0.7A and 4.6A. The results on the strong absorbers Au, Ag, and In were analyzed into absorption and scattering contributions. The absorbers exhibited essentially the $1/v$ characteristic expected. The scattering and absorption cross sections of Au, Ag, and In are compared with previously reported values. For the strong scatterers Ni and NiO, the total scattering, ordered scattering, and disordered scattering cross sections, and the Debye temperature were derived from the energy dependence of the total cross section. The ordered scattering cross section per Ni nucleus was found to be 13.1 ± 0.3 barns. The capture and ordered elastic contributions were subtracted from the experimental curve of total cross section vs energy. This residual scattering function of energy was compared to that theoretically expected from a Debye independent-oscillator model and the one-phonon incoherent scattering approximation of Kleinman. In the case of Ni, at the longer wavelengths, both models fit the data well, and at the shorter wavelengths, where multiple phonon processes occur, the independent oscillator model continues to fit the data. For NiO, measurements fit the independent oscillator model at the shorter wavelengths, and lie above the values calculated from either model at the longer wavelengths. Additional measurements of the total cross section of NiO as a function of temperature would be needed to attribute the difference between measured and calculated values at the longer wavelengths definitely to inelastic scattering processes. (auth)

1392

NEUTRON-PROTON SCATTERING AT 91 MEV. R. H. Stahl and N. F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev. 96, 1310-15(1954) Dec. 1.

The angular distribution of neutrons scattered by protons has been measured for center-of-mass scattering angles between 60° and 180°. The effective neutron energy was 91 ± 1 Mev. A liquid hydrogen scatterer and plastic scintillation proton counters were used. The experimental results are in good agreement with previous experiments at this energy. (auth)

1393

(d,p) REACTIONS FROM CARBON, NITROGEN, AND OXYGEN. A. Sperduto, W. W. Buechner, C. K. Bockelman, and C. P. Browne (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 1316-22(1954) Dec. 1.

Proton groups from the deuteron bombardment of thin targets of Formvar, polyethylene, and nylon have been analyzed by magnetic deflection in a 180-degree spectrograph and at 90 degrees to the incident beam. The MIT-ONR electrostatic generator was used to provide a deuteron beam at several energies ranging from 5 to 8.5 Mev. A total of twenty-eight individual proton groups has been observed. On the basis of both the relative intensities from the different targets and the differential energy shift, all the groups were identified with levels in C^{13}, C^{14}, N^{15}, or O^{17}. The present investigation covers the region of excitation up to energies corresponding approximately to the neutron binding energy in each of these nuclei. The results confirm previous knowledge of four proton groups from the $C^{12}(d,p)C^{13}$ reaction; two groups from $C^{13}(d,p)C^{14}$; seven groups from $N^{14}(d,p)N^{15}$; and four groups from $O^{16}(d,p)O^{17}$. In addition, eleven new particle groups were observed, two arising from the $C^{13}(d,p)C^{14}$ reaction and corresponding to energy levels in C^{14} at 6.723 and 6.894 Mev, and the remaining nine groups from the $N^{14}(d,p)N^{15}$ reaction and corresponding to levels in N^{15} at 7.575, 8.571, 9.062, 9.834, 10.069, 10.458, 10.544, 10.705, and 10.811 Mev. (auth)

1394

PROTON-PROTON SCATTERING AT 5.77 MEV. E. J. Zimmerman, R. O. Kerman, Sidney Singer, P. Gerald Kruger, and W. Jentschke (Univ. of Illinois, Urbana). Phys. Rev. 96, 1322-32(1954) Dec. 1.

Absolute differential scattering cross sections for proton-proton scattering at laboratory energies of 5.77 and 5.86 Mev (± 1 percent) have been obtained with an accuracy of about one percent at many angles (23° to 110° c.m.) by two independent experiments, one employing nuclear emulsion plates as detectors and the other employing proportional counters. Reduced to the same energy, the average indicated S-wave nuclear phase shift is in excellent agreement with other data for this energy region. However, at small scattering angles, important for determining a P-wave phase shift, the measured cross sections differed originally by 3 to 5 percent, the nuclear emulsions method indicating a P-wave shift of −0.08 ± 0.05 degree, and the original counter data indicating −0.34 ± 0.05 degree. After the beam collimation was improved and the energy spectrum of the incident proton beam was examined, check runs with the counters at six scattering angles failed to indicate the large P-wave effect, giving −0.08 ± 0.07 degree, in agreement with the emulsion data. It therefore appears likely that the P-wave shift at this energy is small (less than 0.1 degree) and negative, in agreement with other determinations in this energy region. (auth)

1395

DETERMINATION OF ALPHA-ALPHA SCATTERING PHASE SHIFTS. James N. Snyder (Univ. of Illinois, Urbana). Phys. Rev. 96, 1333-4(1954) Dec. 1.

A program is described which makes it possible to carry out a phase shift analysis of alpha-alpha scattering on the ILLIAC. In approximately 5 to 10 min the program can carry out the analysis in terms of up to 6 phase shifts (δ_0, δ_2, . . ., δ_{10}) with a precision comparable to an extremely careful human analysis. The number of scattering angles and the energy of the scattering are limited by 32 and 1 to 150 Mev, respectively. (auth)

1396

ANGULAR DISTRIBUTION OF 12- AND 16-MEV GAMMA RAYS FROM THE PROTON BOMBARDMENT OF A THIN BORON TARGET. H. H. Givin, G. K. Farney, T. M. Hahn, and B. D. Kern (Univ. of Kentucky, Lexington). Phys. Rev. 96, 1337-9(1954) Dec. 1.

The angular distribution of 12- and 16-Mev gamma rays from proton bombardment of thin boron targets has been obtained for proton energies ranging from 0.6 to 2.0 Mev. The angular distribution may be represented by the equation $w(\theta) = 1 + A \cos\theta + B \cos^2\theta$, indicating interference between at least two levels of opposite parity. An analysis of the energy dependence of the coefficients A and B for the 16-Mev gamma rays indicate the interference to be between more than two levels. (auth)

1397

ANGULAR DISTRIBUTION OF PROTONS FROM (d,p) REACTIONS ON Be^9, N^{14}, AND Zn^{68}. F. S. Eby (Univ. of Illinois, Urbana). Phys. Rev. 96, 1355-62(1954) Dec. 1.

The (d,p) stripping theory of Butler has been employed in the interpretation of the angular distributions of protons resulting from the bombardment of foil targets of Be^9, N^{14}, and Zn^{68} by 11.9-Mev deuterons. A NaI(Tl) scintillation counter was used to detect protons emitted between angles of 5° and 90°, and pulses were recorded on a 35-mm film strip for pulse height analysis. The distribution of protons from the reaction $N^{14}(d,p)N^{15}$ leaving N^{15} in its doublet first excited state was found to have a peak in the forward direction, indicating that the conclusion previously reached, i.e., that high momentum transfers are involved in this reaction, is probably incorrect. Although it was not possible to do so in the present work, it appears that stripping theory might be used to account for the proton distribution from this reaction if deuterons of higher energy were used. The orbital momenta of a pair of isomeric levels in the nucleus Zn^{69} as determined from the proton distributions and stripping theory are in agreement with the shell model assignments of $p_{1/2}$ for the ground state and $g_{9/2}$ for the 436-kev level. Higher excited levels of Zn^{69} are indicated at about 770 kev and 1.6 Mev. The distribution of the proton group leaving the final nucleus with an excitation of 770 kev is characterized by a momentum transfer, $l_n = 2$. The Q value for the reaction leaving Zn^{69} in the ground state was determined to be 4.16 ± 0.15 Mev. (auth)

1398

SCATTERING OF LIGHT OF VERY LOW FREQUENCY BY SYSTEMS OF SPIN $\frac{1}{2}$. F. E. Low (Univ. of Illinois, Urbana). Phys. Rev. 96, 1428-32(1954) Dec. 1.

It is shown that the first two terms in the expansion of the scattering amplitude of light by a system of spin $\frac{1}{2}$ in powers of the frequency can be simply expressed in terms of the macroscopic properties of the system. The first term is the well known Thomson amplitude, and depends only on the total charge and mass. The second term is found to depend only on the charge, mass, and magnetic moment of the system. (auth)

1399

SCATTERING OF LOW-ENERGY PHOTONS BY PARTICLES OF SPIN $\frac{1}{2}$. M. Gell-Mann and M. L. Goldberger (Univ. of Chicago, Ill.). Phys. Rev. 96, 1433-8(1954) Dec. 1.

The first two terms in a frequency expansion of the photon scattering amplitude are considered in the case where the scatterer is a particle of spin $\frac{1}{2}$. It is shown that an exact calculation in quantum field theory gives results identical with those obtained by classical methods or else by use of the Dirac equation with an anomalous Pauli moment. The results depend only on the charge, mass, and magnetic moment of the scatterer. In the case of the proton, the second term, arising from scattering by the magnetic moment, appears to be negligible in comparison with effects due to Thomson and Rayleigh scattering. (auth)

1400

POLARIZATION OF FAST PROTONS AND NEUTRONS. L. I. Levintov. Uspekhi Fiz. Nauk 54, 285-314(1954) Oct. (In Russian)

A fairly detailed elucidation of the subject is presented. 16 references. (G.Y.)

RADIOACTIVITY

1401

TWENTIETH ANNIVERSARY OF THE DISCOVERY OF ARTIFICIAL RADIOACTIVITY. A. P. Ratner. Zhur. Obshchei Khim. 24, 1897-1901(1954) Nov. (In Russian)

A brief history of the discovery of artificial radioactivity is given. (G.Y.)

1402

GAMMA RADIATION FROM Ce^{144} AND Pr^{144}. W. E. Kreger and C. Sharp Cook (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Phys. Rev. 96, 1276-8(1954) Dec. 1.

The gamma radiation following the decay of Ce^{144} and Pr^{144} has been studied with a 4-in. diameter, 4-in. high cylindrical NaI(Tl) crystal, and single-channel and twenty-channel pulse-height analyzers. With the acid of photopeak to total ratios, previously determined for this crystal, the relative gamma-ray intensities have been determined in terms of the 0.134 Mev gamma ray of Ce^{144}. If an intensity of unity is assumed for the 0.134-Mev gamma radiation, the photon radiation intensities for the 0.081, 0.696, 1.49, and 2.185-Mev transitions are respectively 0.287, 0.116, 0.023, and 0.059. (auth)

1403

ENERGIES OF THE RADIATIONS FROM Ce^{144} AND Pr^{144}. J. M. Cork, M. K. Brice, L. C. Schmid (Univ. of Michigan, Ann Arbor). Phys. Rev. 96, 1295-7(1954) Dec. 1.

With scintillation and magnetic photographic spectrometers the energies of the gamma rays from Ce^{144} have been re-evaluated. Several previously reported gamma rays are believed not to exist, while certain others not reported are found to occur. Gamma energies of 33.4, 40.8, 53.2, 59.0, 79.9, 95.0, 133.5, and 145.2 kev are found. Coincidence measurements together with a consideration of energy relationships indicate a reasonable level scheme for the Pr^{144} nucleus. The energies of the three high-energy gamma rays in Nd^{144} following beta decay of Pr^{144} are 0.688, 1.49, and 2.18 Mev. Some relative intensity measurements are made of the conversion electron lines, leading to a prediction of the multipolarities for three of the gamma transitions. The beta spectrum from Ce^{144} resolves into components with upper energies of 327, 258, and 160 kev. The beta radiation from Pr^{144} has an upper energy limit at 3.12 Mev with a lower energy component whose maximum energy is 0.92 Mev. (auth)

1404

DISINTEGRATION OF Ce^{139}. Charles H. Pruett and Roger G. Wilkinson (Indiana Univ., Bloomington). Phys. Rev. 96, 1340-3(1954) Dec. 1.

The decay of Ce^{139} is shown to proceed by s-electron capture to a single excited state of La^{139} with the subsequent emission of an internally converted gamma ray. Magnetic beta-ray spectrometry and scintillation coincidence techniques have been used to show that the 166-kev gamma ray is magnetic dipole in character. The measured K/(L + M) ratio is 6.6 ± 0.3. An estimation of the K internal conversion coefficient yields 0.20 ± 0.05 and the lifetime of the excited level is found to be less than 10^{-8} sec. An upper limit of 315 kev is found for the total disintegration energy. Although no estimate of orbital electron capture to the ground state can be made, a small amount is probable. A value of 0.94 ± 0.02 for the K fluorescent yield at Z = 57 is obtained from the experiment. (auth)

1405

RADIATIONS FROM Ho^{164}. Hugh N. Brown and Robert A. Becker (Univ. of Illinois, Urbana). Phys. Rev. 96, 1372-8 (1954) Dec. 1.

The decay modes of 36.7-min Ho^{164} have been studied with a magnetic spectrometer, scintillation spectrometer, and proportional counter. Decay to the two even-even daughters, Dy^{164} by orbital electron capture, and Er^{164} by beta decay, is indicated. The beta spectrum appears to be complex, with maximum energy 0.99 ± 0.03 Mev. Gamma rays of energy 90.5, 72.8, and 37.3 kev, together with x rays at 45.7 kev, are found. There is also evidence for a gamma ray at approximately 46 kev. Photon-photon coincidences are found for 46 to 73 and 37 to 46 kev approximate energies. Photon-beta coincidences are found to involve photons of approximate energy 91 and 50 kev. The data are interpreted in terms of first excited levels at 72.8 kev in Dy^{164}, 90.5 kev in Er^{164}, with probably a second level in Dy^{164} at 110 kev. Delayed photon-beta and photon-photon coincidences were found with a half life of 1.4×10^{-9} sec. The former are associated with the 90.5-kev level of Er^{164}; the assignment of the photon-photon coincidences is uncertain. A possible isomeric transition in Ho^{164} is also suggested. Spin and parity assignments, on the basis of conversion coefficients and log $(f_0 t)$ value, are made for certain of the levels. (auth)

1406

THE ANGULAR CORRELATION OF SUCCESSIVE γ-RAYS IN ^{60}Ni AT LOW TEMPERATURES. H. R. Lemmer and M. A. Grace (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A67, 1051-7(1954) Dec.

The angular correlation of the γ rays excited in the decay of Co^{60} has been measured in a paramagnetic crystal at temperatures of 288 and 20°K in order to determine the influence of relaxation phenomena. No significant difference between the measurements was observed, each giving the full angular correlation. This result is discussed in relation to the interpretation of nuclear orientation measurements. (auth)

1407

RADIATIONS FROM Y^{90}, Zr^{97}, Pr^{142}, AND Pr^{143}. B. L. Saraf, J. Varma, and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). J. Franklin Inst. 258, 516-17(1954) Dec.

The radiations of the above listed radionuclides have been investigated with the aid of scintillation spectrometers employing crystals of NaI(Tl). A pure sample of Y^{90} was found to emit γ rays in an amount of at most 10^{-6} photon per disintegration. Zr^{97} was produced by slow neutrons on isotopic Zr^{96}. The gamma rays of the 17-hr $Zr^{97} \xrightarrow{\beta} Nb^{97} \xrightarrow{\beta} Mo^{97}$ are of energies 0.67, 0.75, and 1.6 Mev, the hardest quantum appearing in only 2% of the disintegrations. A sample of praseodyminum oxide (99.98% pure) was irradiated by neutrons to produce Pr^{142} which was found to decay with emission of a single γ ray at 1.6 Mev. No γ rays were detected in the disintegration of Pr^{143}. Any present were estimated to have an intensity of upper limit 10^{-5} photon per disintegration. (entire paper)

1408

ENERGY LEVELS OF Rh^{103} FROM THE DECAY OF Pd^{103} AND Ru^{103}. Babulal Saraf (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). J. Franklin Inst. 258, 517(1954) Dec.

The decay schemes of Pd^{103} and Ru^{103} have been studied with the use of two scintillation spectrometers in coincidence. It has been observed that the electron activity of Pd^{103} is accompanied by faint γ radiation having the several quantum energies of 40, 65, 300, 365, and 495 kev with absolute intensities per disintegration of 1×10^{-3}, 4×10^{-5}, 1.2×10^{-4}, 6.6×10^{-4}, and 1×10^{-4}. The γ rays of energy 65 and 300 kev were found to be in coincidence. The inner bremsstrahlung spectrum associated with the capture transition leading to the 57-min isomeric level in Rh^{103} is of intensity small in comparison with that of the above mentioned γ rays. The β decay of Ru^{103} is accompanied by γ rays of energies 55, 440, 495, 555, and 610 kev with absolute intensities per disintegration of 1×10^{-2}, 5×10^{-3}, 0.90, 5×10^{-3}, and 6×10^{-2}. A β spectrum of end point 110 ± 10 kev is coincident with the 610-kev γ ray. A level scheme for Rh^{103} with probable orbitals has been proposed. (entire paper)

1409

STUDY OF THE Hg^{195}-Au^{195} DISINTEGRATION BY β-γ COINCIDENCE SPECTROMETRY. J. Brunner, J. Halter, O. Huber, R. Joly, and D. Maeder (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 572-6(1954) Nov. (In German)

1410

THE α VELOCITY SPECTRUM OF POLONIUM ISOTOPES. Salomon Rosenblum and Helge Tyrén. Compt. rend. 239, 1205-7(1954) Nov. 8. (In French)

Values of the α energies and lifetimes of the lightest Po isotopes are given. Several groups of velocities are pointed out for the first time. (tr-auth)

1411

ON THE CONVERSION SPECTRA OF THE ELEMENTS Ba^{137} AND Ba^{134}. Julien Verhaeghe and Jean Demuynck. Compt. rend. 239, 1374-6(1954) Nov. 22. (In French)

1412

THE DECAY OF As^{71}. Sigvard Thulin, Jean Moreau, and Hugo Atterling (Nobel Inst. of Physics, Stockholm, Sweden). Arkiv Fysik 8, No. 3, 219-28(1954).

The decay of 65-hr As^{71} has been studied using electromagnetically separated samples. The isotope decays by K capture and positron emission. The probability ratio of K capture to positron emission is 2.1 ± 1. It was found that at least 97% of the positrons correspond to a β^+ transition of energy 813 ± 10 kev. Two γ rays of energies 23.3 ± 0.3 and 174.5 ± 0.4 kev were recorded by means of their conversion electrons. The K/(L + M) ratios are respectively 5.4 ± 0.8 and 8.9 ± 1. $\gamma - e^-$ and $\gamma - \beta^+$ coincidence measurements were performed. A decay scheme is proposed. (auth)

1413

THE DECAY OF Kr^{79}. Sigvard Thulin, Jean Moreau, and Hugo Atterling (Nobel Inst. of Physics, Stockholm, Sweden). Arkiv Fysik 8, No. 3, 229-38(1954).

The β spectrum of 34.5-h Kr^{79} has been remeasured. The positron spectrum was found to be complex, with two components of energies 598 ± 5 and 325 ± 20 kev and intensities 93 and 7%, respectively. In addition to two earlier reported gamma rays the conversion electrons of 13 more gamma rays have been found. $\beta^+\gamma$ and $e^-\ \gamma$ coincidence measurements have been performed. Tentative level schemes are given. (auth)

SPECTROSCOPY

1414

Yale Univ.
ISOTOPE SHIFT IN THE X-RAY SPECTRA OF HEAVY ELEMENTS. M. S. Wertheim and G. Igo. Dec. 1954. 16p. Contract AF 18 (600)-771, Technical Report No. 8. (OSR-TN-54-347)

Isotope shifts in the x-ray levels due to the nuclear volume effect were calculated for three different nuclear potentials by using first-order perturbation theory with the relativistic wave functions in a Coulomb field. In order to correct for the error made in using first-order perturbation theory, the exact relativistic wave function was obtained for one of the potentials. The screening effects of the atomic electrons were taken into account by comparing the value of the wave function at the nuclear radius in a Fermi-Thomas field with that in a Coulomb field. An upper limit is obtained on contributions to the isotope shift due to the change in screening of the other atomic electrons when a K or L shell electron is removed or replaced. The results for isotope shift in Mo and U are one-half and one-twentieth, respectively, of the experimental resolution of Rogosa and Schwarz. (auth)

1415

ISOTOPE SHIFT IN THE SPECTRA OF TIN AND LEAD. Kiyoshi Murakawa (Institute of Science and Technology, Komaba-machi, Meguro-ku, Tokyo, Japan). J. Phys. Soc. Japan 9, 876-7(1954) Sept.-Oct.

The Sn II spectrum was excited by a liquid-air cooled hollow discharge tube, the discharge current being less than 20 ma. The hyperfine structure was examined with a Fabry-Perot etalon, and data are presented on observed isotope shift. Data are included on the isotope shift observed in the spectrum of Pb I, which appeared as impurity lines in the studies on Sn. (C.H.)

THEORETICAL PHYSICS

1416

Brookhaven National Lab.
A GENERALIZED SPIN REPRESENTATION. 1. REPRESENTATION IN TERMS OF OPERATIONS ON ANALYTIC FUNCTIONS OF AN ARBITRARY VARIABLE. Edward V. Sayre and Sheldon L. Matlow. [1953?]. 12p. (BNL-1794)

Spin representations involving operations upon analytic functions are presented. All orthonormal sets of functions derivable as linear combinations of these functions can serve as bases of additional representations. In the derived representations the operators will be linear combinations of the original operators with real coefficients. Within an interderivable set of representations both operators and functions can have real, imaginary, and complex form. (auth)

1417

Brookhaven National Lab.
A GENERALIZED SPIN REPRESENTATION. [PART] 2. GENERALIZATION OF THE KRAMER'S DEGENERACY THEOREM. Sheldon L. Matlow and Edward V. Sayre. [1953]. 10p. (BNL-1816)

Previous derivations of the Kramer's degeneracy theorm have been based upon the property of the Pauli spin representation that σ_z and σ_x are real operators and σ_y is imaginary. This property is peculiar to the Pauli representation and not general to spin operators. However, spin operators can always be written as linear combinations of an imaginary and two real spin operators with real coefficients. On the basis of this a derivation similar to the earlier ones is given which is general for all spin representations. (auth)

1418

National Bureau of Standards
THE STATISTICAL THERMODYNAMICS OF ISOTOPE EFFECTS. 1. THEORY OF EQUILIBRIUM PROCESSES. Irwin Oppenheim. Oct. 31, 1954. 17p. (NBS-3756)

The quantum statistical mechanics of almost classical assemblies were investigated as part of a long-range program on the theoretical treatment of isotope effects. Only interactions which are low frequency in the sense of Van Vleck were included. Series expansions for the quantum mechanical partition function, distribution functions, and thermodynamic functions were developed. (M.P.G.)

1419

ON THE SCHRÖDINGER EQUATION FOR THE HELIUM ATOM. (Ob Uravnenii Shredingera Dlia Atoma Geliia). V. A. Fock. Translated by G. Belkov from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 18, 161-72(1954). 20p. (TT-503)

1420

DECAY INTO PARTICLES WITH ZERO REST MASS. I. S. Shapiro (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 27, 393-7(1954) Oct. (In Russian)

Selection rules for decay of particles into two particles with arbitrary spin, of which at least one has zero rest mass, are derived. (tr-auth)

1421

THEORY OF THE STRONG COUPLING OF PARTICLES (NUCLEONS) WITH MESON FIELDS. S. I. Pekar. U. Zhur. Eksptl'. i Teoret. Fiz. 27, 398-410(1954) Oct. (In Russian)

A theoretical investigation of particles strongly interacting with the fields of charged and neutral mesons is presented. (G.Y.)

1422

QUANTUM THEORY OF THE RADIATING ELECTRON. II. N. F. Nelipa. Zhur. Eksptl'. i Teoret. Fiz. 27, 421-30(1954) Oct. (In Russian)

1423

PHASE OF MATRIX ELEMENTS IN NUCLEAR REACTIONS AND RADIOACTIVE DECAY. R. Huby (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A67, 1103-5(1954) Dec.

An error in the phase of matrix elements in nuclear reactions, which has been transmitted through several recent papers, is reported. This error occurred in the normalization of the wave function in a paper by Wigner and Eisenbud (Phys. Rev. 72, 29(1947)), which has been taken as the basis of most later work on nuclear reactions. (L.T.W.)

PATENTS

CHEMISTRY

1424

LIQUID SAMPLER. J. A. Casler, H. O. Smith, L. F. Coleman, and M. Levenson (to U. S. Atomic Energy Commission). U. S. Patent 2,693,705, Nov. 9, 1954.

A convenient apparatus for handling samples of radioactive corrosive or valuable liquids is described. The liquid to be sampled is removed from the source container by an aspirator into a sampling container and into the aspirator stream back into the source container. A representative sample is assured because of natural agitation.

1425

RECOVERY OF ZIRCONIUM TETRACHLORIDE FROM ITS COMPLEX COMPOUNDS. W. C. Fernelius (to U. S. Atomic Energy Commission). U. S. Patent 2,695,213, Nov. 23, 1954.

A method for the recovery of zirconium tetrachloride from complex compounds of zirconium tetrachloride and phosphorus pentachloride consists of two steps wherein the phosphorus pentachloride is reduced with phosphorus or magnesium to the trichloride and removed by distillation, after which the zirconium tetrachloride formed in the same reaction is vaporized from the residue and condensed.

1426

METHOD OF MAKING METALLIC OXYFLUORIDES. D. W. Sherwood and G. C. Banikiotes (to U. S. Atomic Energy Commission). U. S. Patent 2,695,214, Nov. 23, 1954.

The method of making tungsten oxyfluoride consists of continuously passing fluorine over tungsten trioxide and continuously removing a gaseous mixture containing the desired oxyfluoride which is condensed as a liquid and thence as a solid.

ENGINEERING

1427

VACUUM PUMPING APPARATUS. K. M. Simpson (to U. S. Atomic Energy Commission). U. S. Patent 2,691,481, Oct. 12, 1954.

Pumping apparatus is described for the production of high vacuum of the vapor-stream type. Size limitations are overcome enabling the production of higher vacuum with fewer pumping systems. One or more rectangular openings of the chamber to be evacuated communicate in tapered configuration to a substantially rectangular discharge opening maintained under reduced pressure by mechanical pumps. The higher vacuum is obtained by a fast moving, continuously recycled, vapor stream introduced from boilers through elongated tubular vapor jets disposed in spaced relation longitudinally in the discharge path.

1428

VALVE LEAK DETECTOR. H. V. Lichtenberger (to U. S. Atomic Energy Commission). U. S. Patent 2,691,773, Oct. 12, 1954.

A valve for fluids at above atmospheric pressure is described which replaces the conventional packing glands with a positive type seal. This is accomplished by designing the valve to be seated by rotating a nut rigidly attached to the valve handwheel which moves a shaft into its seat to close the valve. The seal is provided by two flexible bellows, one within the other, with their ends attached to the moving shaft and its stationary housing, respectively. Indicating means are provided to detect failure of either of the bellows.

1429

PRESSURE ASCERTAINING MEANS. C. V. Osborne (to U. S. Atomic Energy Commission). U. S. Patent 2,693,700, Nov. 9, 1954.

A device adapted to ascertain static gas pressure adjacent to a body moving through the air regardless of whether relative motion between the body and air is at comparatively low speeds or in the vicinity of Mach number unity or higher is described. This is accomplished by attaching a specially designed rigid tubular member, with a cone-shaped end, to the body by means of a flexible steel cable in such a manner that the tubular member will trail at a specified distance behind the body. Pressure indications are received through radial aperatures in the wall of the rigid tube and are passed through the flexible cable to a pressure responsive apparatus located within the moving body.

1430

PYROMETER. R. A. Wolfe (to U. S. Atomic Energy Commission). U. S. Patent 2,695,364, Nov. 23, 1954.

A method and apparatus for measuring elevated temperatures over a wide range are described. This is accomplished by exposing a pair of apertured Geiger-Mueller counters characterized by the different work functions of their cathodes to the radiations emitted from the source of heat, counting the rate of occurrence of discharges of the counters, and deriving an electrical signal proportional to the ratio of these counting rates. The magnitude of this signal is directly proportional to the temperature of the source.

MINERALOGY, METALLURGY, AND CERAMICS

1431

URANIUM–NICKEL METAL ALLOY. M. E. Cieslicki and B. J. Nelson (to U. S. Atomic Energy Commission). U. S. Patent 2,692,823, Oct. 26, 1954.

A binary uranium–nickel alloy useful in the construction of neutronic reactors is reported. The invention is directed to a peritectic compound having the formula U_6Ni. The corrosion resistance of uranium and uranium-rich alloys is improved by the incorporation of a quantity of nickel.

1432

FLOTATION METHODS FOR URANIUM ORES. G. A. Bennett and P. L. Veltman (to U. S. Atomic Energy Commission). U. S. Patent 2,697,518, Dec. 21, 1954.

A froth flotation process is reported for the recovery of uranium values from artificial ore-like materials which comprises adding to a pulpy mixture of water and ore material a flotation agent consisting of anionic or nonionic synthetic detergents and/or soluble soaps of fatty acids and rosin acids whereby the uranium values are concentrated in the froth and recovered.

PHYSICS

1433

HIGH-VOLTAGE BUSHING. H. M. Owren (to U. S. Atomic Energy Commission). U. S. Patent 2,692,297, Oct. 19, 1954.

An improved high-voltage bushing for use in connection with the isolation of either large a-c or d-c voltages is described. Its advantages, including decreased size, are obtained by a combination of insulations particularly adapted for a-c and d-c voltages, by the elongation of the voltage creep path, and by expansion of the areas having potential differences between.

1434

PULSE ANALYZER. E. Fairstein (to U. S. Atomic Energy Commission). U. S. Patent 2,694,146, Nov. 9, 1954.

Differential-integral pulse-height analyzers for fast operation having dead times as low as 1 microsecond or less are described. This is accomplished in part by providing a differential-integral pulse-height analyzer which responds to various forms of driving pulses wherein the pulse shape is not critical by providing an impedance transformer for coupling the integrating circuit to the pulse shaping circuit, and by providing an anti-coincident circuit where the pulse height of the driving signal is independent of and not affected by the aging of the tubes.

1435

PROCESS FOR THE CONCENTRATION OF ISOTOPES. C. A. H. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,695,268, Nov. 23, 1954.

An improvement in the electrolytic fractionation of hydrogen isotopes is described, wherein greater recovery of the heavier isotopes contained in the vapor and spray is obtained by causing the spray and vapor to pass through a drying vessel containing caustic. The caustic solution collected in the drying vessels is fed to cells containing electrolyte of approximately similar isotopic concentration while the residual gases are burned to form water and deuterium oxide and fed in a like manner to cells containing electrolyte of equal concentration.

1436

REMOTE-CONTROL MANIPULATOR. R. C. Goertz and R. G. Schmitt, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,695,715, Nov. 30, 1954.

This device enables an operator to stand behind a protective wall while handling noxious materials by means of a remote-control manipulator. The manipulator is characterized by a localizing of the many connections between the arms of the manipulator so as to simplify its mounting in the protective wall. The manipulator has seven types of movement and is suitably balanced so that the arms will remain in any position to which they have been moved.

1437

ATOMIC BOMB AIR ZERO LOCATOR. B. C. Taylor (to U. S. Atomic Energy Commission). U. S. Patent 2,696,050, Dec. 7, 1954.

The atomic bomb burst direction indicator suitable for civil defense purposes comprises a hollow sphere of fibrous material of low thermal conductivity, a dull nonreflecting, heat scorchable lacquer coating on the exterior of the sphere, and latitude and longitude markings. The sphere is bolted to a concrete base in an oriented position so that the direction of the blast can be determined by the area of the sphere which has been scorched by the blast.

1438

ELECTROSTATIC AMPLIFIER. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,696,530, Dec. 7, 1954.

The variable capacitance amplifier embodies the desirable control characteristics of electromagnetic amplifiers without the attendant disadvantages. This is accomplished by employing electrically responsive capacitors whose capacitance is varied by a direct current signal voltage impressed thereon. This provides a power amplifier employing high-frequency electrical energy to produce d-c power proportional to a d-c control bias.

1439

DUAL CIRCUIT ELECTRICAL SAFETY DEVICE. E. W. Peterson (to U. S. Atomic Energy Commission). U. S. Patent 2,696,539, Dec. 7, 1954.

Means for simultaneously interrupting a plurality of electric circuits is described. This is accomplished by mounting two opposing sets of contacts on resilient conducting members which are spaced apart by insulating material at one end joined together by a fuse element at their other end in such a manner as to hold the opposing sets of contacts in a closed position. Malfunction of the circuit through the aforesaid resilient conductors will blow the fuse connecting them which permits the contacts mounted thereon to spring apart thus breaking their circuits.

1440

RADIO ELECTRIC GENERATOR. P. E. Ohmart (to U. S. Atomic Energy Commission). U. S. Patent 2,696,564, Dec. 7, 1954.

Methods and apparatus for converting the energy of radioactive radiations directly to electrical energy are described. A radiation detector is provided, which itself serves to generate an electrical current from the energy of the ionizing radiations and accordingly requires no external source of electrical energy. The current generated is proportional to the amount of radiation.

1441

APPARATUS FOR HANDLING FRANGIBLE ARTICLES BY REMOTE CONTROL. J. P. Hubbell and H. J. Reining (to U. S. Atomic Energy Commission). U. S. Patent 2,697,529, Dec. 21, 1954.

An apparatus for handling frangible articles by remote control is described. In a more limited aspect the invention is especially well adapted for handling frangible crucibles for radioactive material. The device provides means for securely engaging such containers at will, moving them from station to station, and for directing the containers through various lifting, revolving, and depositing steps at each of the stations without damaging the crucibles.

1442

ION SOURCE. R. R. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,697,788, Dec. 21, 1954.

An ion source is described wherein a vapor of a material of which ions are desired is produced within a slot formed of anodes which produce an electric field for accelerating electrons emitted from a filament. A magnetic field is produced in a direction transverse to the electric field which influences the path of the electrons. A high negative potential is advantageously employed outside the ion-producing slot which serves to withdraw the positive ions produced and reverses the direction of the electrons to increase their ionizing power.

1443

THE ISOTOPE OF CURIUM HAVING A MASS NUMBER OF 238. G. T. Seaborg and K. Street, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,698,290, Dec. 28, 1954.

A method of producing Cm^{238} by bombarding Pu^{239} with 80-Mev alpha particles from a cyclotron and chemically separating the curium from the complex mixture of products including several curium isotopes, the original target material, and a variety of rare earth fission products are described. The Cm^{238} is identified by means of an alpha particle pulse analysis.

1444

MAGNETIC TIME-OF-FLIGHT MASS SPECTROMETER. S. A. Goudsmit (to U. S. Atomic Energy Commission). U. S. Patent 2,698,905, Jan. 4, 1955.

An improved time-of-flight mass spectrometer was designed which offers means for measuring the mass of ions with increasing accuracy as their mass increases. This is achieved by making use of the fact that an ion released in a homogeneous field describes a helical path and, irrespective of its velocity and direction of release, its angular velocity is constant. Consequently, the time of flight for one revolution of the ion is independent of the velocity of release and depends only on the mas-to-charge ratio of the ion in a given magnetic field. A collector electrode is so positioned that it will collect ions of a given mass after one complete revolution, those of another mass after two revolutions, etc. By using the relation between the time of flight for one revolution and the mass of the ion, one can then very accurately calculate the mass of the ions present.